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REPORT OF THE INTERNATIONAL ATOMIC ENERGY AGENCY

Note by the Secretary-General

1. The thirtieth report of the International Atomic Energy Agency for the calendar year 1985 (GC(XXX)/775) is submitted herewith to the General Assembly. Major developments since this report was published will be covered by the annual statement of the Director-General of the Agency to the General Assembly. This report has been transmitted in accordance with the provision of article III, paragraph 1 (a), of the Agreement governing the relationship between the United Nations and the International Atomic Energy Agency (General Assembly resolution 1145 (XII), annex).
2. As only a limited number of copies of this report is available, it has not been possible to make a full distribution. Delegations are therefore requested to have the copies transmitted to them available during the discussion of this item.

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THE ANNUAL REPORT FOR 1985

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INTERNATIONAL ATOMIC ENERGY AGENCY

THE ANNUAL REPORT FOR 1985

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LIST OF ABBREVIATIONS

AGRIS	Agricultural Information System
ARCAL	Regional co-operative arrangements for the promotion of nuclear science and technology in Latin America
BWR	Boiling-water reactor
CANDU	Canadian deuterium-uranium (reactor)
CCAQ	Consultative Committee on Administrative Questions
CEC	Commission of the European Communities
C/S	Containment/surveillance
EEC	European Economic Community
FAO	Food and Agriculture Organization of the United Nations
ICSC	International Civil Service Commission
ILO	International Labour Organisation
INTOR	International Tokamak Reactor
LMFBR	Liquid-metal fast breeder reactor
LWR	Light-water reactor
MOX	Mixed-oxide (fuel)
NDA	Non-destructive assay
NEA	Nuclear Energy Agency of OECD
NNW	Non-nuclear-weapon (State)
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NUSS (programme)	The Agency's programme on nuclear safety standards for nuclear power plants
NW	Nuclear-weapon (State)
OECD	Organization for Economic Co-operation and Development
OSART	Operational Safety Review Team
PWR	Pressurized-water reactor
R&D	Research and Development

RAPAT	Radiation protection advisory team
RCA	Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (INFCIRC/167)
SQ	Significant quantity
Tlatelolco Treaty	Treaty for the Prohibition of Nuclear Weapons in Latin America
UNDP	United Nations Development Programme
UNEP	United National Environment Programme
UNIDO	United Nations Industrial Development Organization
UNIPED	International Union of Producers and Distributors of Electrical Energy
UNJSPB	United Nations Joint Staff Pension Board
VIC	Vienna International Centre
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.

I N T R O D U C T I O N

Nuclear power

1. The total installed nuclear power generating capacity in the world increased by 13.7% during 1985, reaching 250 GW(e) by the end of the year. Nuclear power plants accounted for 15% of the world's electricity generation in 1985, at the end of which there were 374 nuclear power plants in operation (see Table 1); 32 new plants came on line during the year.
2. There was still no general upturn in the ordering of nuclear power plants, and construction work started on only six new plants. However, vigorous nuclear power programmes continued in a number of Member States - notably France, Japan and the East European Member States belonging to CMEA. At the same time, five developing countries (China, Egypt, the Republic of Korea, Turkey and Yugoslavia) issued bid invitations or were negotiating contracts for nuclear power plants. Two new plants came on line in developing countries, one in India and one in the Republic of Korea.
3. Last year was the first year since 1973 without any cancellations of nuclear power plant orders or suspensions of plant construction.
4. Three nuclear power plants (El-4 and Chinon-A2 in France and VAK Kahl in the Federal Republic of Germany) were permanently shut down at what was judged to be the end of their economically useful lifetimes.
5. In contrast with the uncertainties about the current nuclear power programmes in some countries, the development of advanced nuclear systems was highlighted in 1985 by three major events: by the start-up of the 1200 MW(e) Super Phénix in France; by the start-up of the THTR 300 prototype high-temperature reactor in the Federal Republic of Germany; and by the start-up of India's fast breeder test reactor.
6. The Agency's efforts to help strengthen nuclear power planning in developing Member States continued, through advisory missions, training courses and guidebooks. Issues relating to the financing of nuclear power programmes were discussed at a seminar where the participants concluded that the Agency could play a useful role by providing commercial lenders with objective information on the technical proveness of nuclear power and that the Agency's involvement in financial feasibility studies would carry considerable weight with lenders and export credit agencies.

Table 1

**Nuclear power reactors in operation
and under construction
at the end of 1985**

Country name	In operation		Under construction		Electricity generated by nuclear power reactors in 1985		Total operating experience (to end 1985)	
	Number of units	Total MW(e)	Number of units	Total MW(e)	TW(e)·h	% of total	Years	Months
Argentina	2	935	1	692	5.2	(11.3) ^{a/}	14	7
Belgium	8	5 486			32.4	59.8	64	1
Brazil	1	626	1	1 245	3.2	(1.7)	3	9
Bulgaria	4	1 632	2	1 906	13.1	31.6	30	6
Canada	16	9 776	6	4 789	57.1	12.7	151	7
China			1	300				
Cuba			2	816				
Czechoslovakia	5	1 980	11	6 284	10.9	14.6	22	4
Finland	4	2 310			18.0	38.2	27	4
France	43	37 533	20	25 017	213.1	64.8	338	5
German Democratic Republic	5	1 694	6	3 432	(12.2)	(12.0)	57	5
Germany, Federal Republic of	19	16 413	6	6 585	119.8	31.2	215	4
Hungary	2	825	2	820	6.1	23.6	4	5
India	6	1 140	4	880	4.0	(2.2)	54	8
Iran, Islamic Republic of			2	2 400				
Italy	3	1 273	3	1 999	6.7	3.8	69	10
Japan	33	23 665	11	9 773	152.0	22.7	286	10
Korea, Republic of	4	2 720	5	4 692	13.9	(22.1)	15	5
Mexico			2	1 508				
Netherlands	2	508			3.7	6.1	29	9
Pakistan	1	125			0.2	0.9	14	3
Philippines			1	620				
Poland			2	880				
Romania			3	1 980				
South Africa	2	1 840			5.3	4.2	2	3
Spain	8	5 577	2	1 920	26.8	24.0	56	10
Sweden	12	9 455			55.9	42.3	99	2
Switzerland	5	2 882			21.3	39.8	53	10
Union of Soviet Socialist Republics	51	27 756	34	31 816	(152.0)	(10.3)	531	7
United Kingdom	38	10 120	4	2 530	53.8	19.3	695	10
United States of America	93	77 804	26	29 258	383.7	15.5	954	11
Yugoslavia	1	632			3.9	(5.1)	4	3
Worldwide ^{a/}	374	249 625	157	141 942	1401.6		3825	3

^{a/} "Worldwide" figures include Taiwan, China, where there are six units with a total capacity of 4918 MW(e) in operation and where a total of 26 years and 1 month of operating experience had been gained.

^{b/} Figures in brackets indicate estimates - no data provided by Member States.

Nuclear safety and radiation protection

7. During 1985 efforts were concentrated on developing radiation protection guidelines and helping Member States to apply them. In addition, the Agency continued to provide a forum for the exchange of scientific information and to support research work in the field of radiation protection.

8. Various guidelines consistent with the system of dose limitation set forth in the Agency's revised Basic Safety Standards for Radiation Protection were elaborated; they encompassed occupational radiation protection, protection of the public, the safe transport of radioactive materials, and emergency planning and preparedness.

9. Activities relating to the safety of nuclear installations placed increasing emphasis on operational aspects. Among such activities were OSART missions to four countries, including a training mission to France, expansion of the Agency's incident reporting system, safety missions to seven research reactor installations, and a seminar on backfitting.

10. The development phase of the Nuclear Safety Standards (NUSS) programme was completed, and the emphasis switched to implementation of the 60 NUSS documents. The International Nuclear Safety Advisory Group (INSAG) held its first two meetings.

Nuclear fuel cycle

11. The Agency's programme continued to cover developments at all stages of the nuclear fuel cycle -- from nuclear raw materials exploration to radioactive waste disposal.

12. Up-to-date assessments of world uranium and thorium resources and supply and of related technologies were used in providing information and advice to Member States. The Agency continued to collect data on the status, capacity, 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 improving the reliability of fuel elements and 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.

13. The short-term outlook for uranium is one of over-supply and falling prices. In 1985, however, for the first time, uranium production fell below the level of reactor-related requirements. The continuing over-supply is due largely to the substantial uranium inventories which have been built up and which are estimated to be equivalent to three-four years of reactor requirements.

14. As a consequence of lower prices, uranium exploration continued to decline.

15. There has been a shift in the geographical distribution of uranium production, the United States no longer being the leading uranium-producing country.

Waste management

16. With radioactive waste management continuing to command general interest within the context of nuclear power development, the Agency issued a status report on the radioactive waste management situation worldwide. Work continued on developing standards designed to assist in the formulation of national waste management regulations for nuclear power plants, sea dumping, and uranium mining and milling. Owing to the increased need for technical information in the waste management area, several reports were produced on waste processing and disposal, decommissioning and environmental aspects of nuclear energy.

Application of nuclear techniques

17. In the area of food and agriculture, the Agency, through the Joint FAO/IAEA Division, continued to help developing Member States to improve their agriculture and food production through the application of isotopes, ionizing radiation and related techniques, especially biotechnology.

18. The establishment of the International Consultative Group on Food Irradiation and the world-wide interest in irradiation for food preservation led to a further increase in the Agency's activities in this field, especially the organization of advisory group and task force meetings on the various problems impeding the widespread commercial use of the process.

19. In the life sciences area, 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.

20. The Agency continued to promote exchanges of information in the physical and earth sciences and to assist both developing and developed countries with the application of nuclear techniques in experimental physics, analytical and radiation chemistry, non-destructive testing, radiation processing, industrial process control, geology, mining and hydrology. An international dose assurance service for irradiation facilities in Member States was initiated.

Technical co-operation

21. Total resources available in 1985 for Agency technical co-operation activities stood at \$38.1 million, or 6.1% higher than in the previous year. The value of the programme delivered was \$33.8 million, a figure 3.5% higher than in 1984.

22. Progress made in programme delivery in 1985 is reflected in the following table.

Item	1983	1984	1985
Number of expert assignments	1099	1530	1846
Number of expert man-months served	1020	1550	1585
Number of expert assignments undertaken by Agency staff	333	378	418
Number of purchase orders processed	2405	2970	3391
Number of fellows in the field	612	702	615
Number of visiting scientists	65	123	188
Number of participants in study tours and training courses	659	850	926

Seibersdorf Laboratory

23. While the basic objective of the Seibersdorf Laboratory continued to be the provision of practical support to Agency programmes, there was a further 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.

24. Construction work continued on a new laboratory wing which is scheduled to be ready for use in September 1986 and will replace the old agricultural building; the costs are being shared by FAO and the Agency.

International Laboratory of Marine Radioactivity

25. In September 1985 the Board of Governors approved a draft Seat Agreement between the Agency and Monaco concerning the International Laboratory of Marine Radioactivity.

International Centre for Theoretical Physics

26. The Centre continued to address physics problems both of immediate practical relevance and of a more fundamental nature through colleges, workshops and other activities relating to physical processes and mathematical modelling. It hosted a conference on south-south and south-north co-operation in science organized by the Third World Academy of Sciences and opened by the Secretary-General of the United Nations.

27. Over 2500 scientist visited the Centre during 1985, staying for a total of almost 2100 man-months; 60% of them were from developing countries, but they accounted for 80% of the total man-months. Under its "Associate Membership" scheme, the Centre welcomed 123 associates from 58 developing countries. Approximately 300 researchers from federal institutes in 50 developing countries visited the Centre.

Twenty-fifth anniversary of the journal "Nuclear Fusion"

28. In 1985 "Nuclear Fusion" had its 25th anniversary. To commemorate the occasion, the Agency produced a special issue containing a comprehensive review of the major nuclear fusion activities over the past quarter of a century.

Safeguards

29. The Agency and the Soviet Union concluded an agreement relating to the latter's voluntary offer to place some of its peaceful nuclear installations under Agency safeguards. The agreement entered into force on 10 June 1985.

30. At the 29th regular session of the General Conference, the delegate of China stated that his country was willing to place some of its peaceful nuclear installations under Agency safeguards. When a safeguards agreement to give effect to China's offer has been concluded, voluntary-offer safeguards agreements will be in force between the Agency and the five nuclear-weapon States.

31. In the autumn, Albania approached the Agency with a view to the conclusion of a safeguards agreement covering all its nuclear activities.

32. In 1985, 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[1]. It is considered reasonable to conclude that nuclear material under Agency safeguards in 1985 remained in peaceful nuclear activities or was otherwise adequately accounted for.

Physical protection of nuclear material

33. At its 29th regular session, the General Conference adopted a resolution on the Convention on the Physical Protection of Nuclear Material in which it expressed the hope "that the Convention will enter into force at the earliest possible date and that it will obtain the widest possible adherence". By the end of 1985, the Convention had been signed by 39 Member States and one regional organization and ratified by 15 States. Six more ratifications are required for its entry into force.

[1] 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.

Committee on Assurances of Supply

34. The Committee on Assurances of Supply (CAS) held its 14th to 17th sessions in January, March, May and November respectively.

35. It continued its consideration of principles of international co-operation in the field of nuclear energy, with the focus of discussion still on the linkage between non-proliferation assurances and assurances of supply.

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

36. The Preparatory Committee of the Conference, at its sixth session, decided to establish a working group to carry out formal/official inter-sessional intergovernmental work and reviewed the input documents furnished by -- inter alia -- the Agency.

37. The General Assembly agreed that the Conference should be held from 23 March to 10 April 1987 at Geneva and that the Preparatory Committee should hold a seventh session from 10 to 21 November 1986 in Vienna.

Third NPT Review Conference

38. The Third Review Conference of the Parties to NPT met from 27 August to 21 September 1985 in Geneva to review the operation of the Treaty during the 15 years since its entry into force. At the request of the Preparatory Committee for the Conference, the Agency's Secretariat had submitted comprehensive documentation on the Agency's activities in connection with Articles III, IV and V of the Treaty. The Conference adopted by consensus a Final Declaration containing several proposals drawn relevant to the Agency's activities.

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

39. Several matters of interest to the Agency were discussed at the 40th session of the General Assembly. In the debate that followed the presentation of the Agency's Annual Report for 1984, 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.

40. In resolution 40/93 on Israeli nuclear armament, the General Assembly reiterated "its condemnation of Israel's refusal to renounce any possession of nuclear weapons", once more requested the Security Council "to take urgent and effective measures to ensure that Israel complies with the Security Council resolution 487 (1981) and places all its nuclear facilities under International Atomic Energy Agency safeguards", reiterated its request to the

Security Council "to investigate Israel's nuclear activities and the collaboration of other States, parties and institutions in these activities", called upon "all States and organizations that have not yet done so to discontinue co-operating with and giving assistance to Israel in the nuclear field" and reaffirmed "its condemnation of the continuing nuclear collaboration between Israel and South Africa".

41. A similar request to the Security Council was made in resolution 40/6 on the Israeli military attack on Iraqi nuclear installations. In this resolution the General Assembly also stated that it considered that "Israel has not yet committed itself not to attack or threaten to attack nuclear facilities in Iraq or elsewhere, including facilities under International Atomic Energy Agency safeguards", requested the Agency "to consider additional measures effectively to ensure that Israel undertakes not to attack or threaten to attack peaceful nuclear facilities in Iraq or elsewhere, in violation of the Charter of the United Nations and in disregard of the safeguards system of the International Atomic Energy Agency" and called for the immediate conclusion of an international agreement on the prohibition of military attacks on nuclear facilities as a contribution to promoting and ensuring the safe development of nuclear energy for peaceful purposes.

42. In resolution 40/64 A the General Assembly took note with appreciation of resolution GC(XXIX)/RES/442 adopted on 27 September 1985 by the General Conference of the Agency on South Africa's nuclear capability, and in resolution 40/89 A it demanded once again that South Africa submit forthwith all its nuclear installations and facilities to inspection by the Agency.

43. In September 1985 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 subsequently also the subject of resolutions adopted by the General Assembly during its 40th session (see paragraphs 40-42 above). In resolution GC(XXIX)/RES/442 the General Conference once again demanded that South Africa immediately submit all its nuclear installations and facilities to Agency safeguards. 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 30th 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(XXIX)/RES/442, 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 30th session of the General Conference on the implementation of that resolution.

44. In resolution GC(XXIX)/RES/443, 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 Conference, stated that it considered "that the letter of 23 September 1985 from the Resident Representative of Israel and the statement by the Representative of Israel on 26 September 1985 contain undertakings on behalf of their Government in response to resolution GC(XXVIII)/RES/425" and noted in particular "the statement that Israel will not attack or threaten to attack any nuclear facilities devoted to peaceful purposes either in the Middle East, including Iraq or anywhere else". It noted that "Israel has

thereby committed itself not to attack peaceful nuclear facilities in Iraq, elsewhere in the Middle East, or anywhere else" and called upon Israel "urgently to place all its nuclear facilities under IAEA safeguards".

Personnel and Finance

45. On 23 September 1985, the General Conference approved the appointment by the Board of Governors of Dr. Hans Blix as Director General of the Agency for a further term of four years, starting on 1 December 1985.

46. At the end of 1985, the number of members of the Secretariat was 1942 - 715 in the Professional and higher categories, 1091 in the General Service category and 136 in the Maintenance and Operative Service category.

47. The Regular Budget total for 1985 was \$95 025 000, of which \$87 340 000 was to be financed from contributions made by Member States on the basis of the 1985 scale of assessment, \$3 414 000 from income from work for others and \$4 271 000 from other miscellaneous income.

THE AGENCY'S ACTIVITIES

TECHNICAL CO-OPERATION

48. **Resources:** Although total resources and disbursements were higher in 1985 than in previous years, growth rates for both declined somewhat. The Technical Assistance and Co-operation Fund (TACF) again accounted for the largest share of technical co-operation resources (66%); increasing by 13% over the previous year's level, they stood at \$25.2 million. As at 31 December 1985, pledges towards the TACF target of \$26 million amounted to \$23.3 million, or 89%. As \$1.9 million was received as additional income, 96.9% of the funds needed to meet the 1985 target became available.

49. A total of \$7.5 million was received in the form of extrabudgetary funds (1984: \$ 9.1 million). In-kind resources stood at \$2.8 million (1984: \$2.1 million) and UNDP funds at \$2.6 million (1984: \$2.5 million). In all, \$38.1 million was available in 1985 for the financing of technical co-operation activities (1984: \$35.9 million). A summary of technical co-operation resources during the last five years is given in Figure 1.

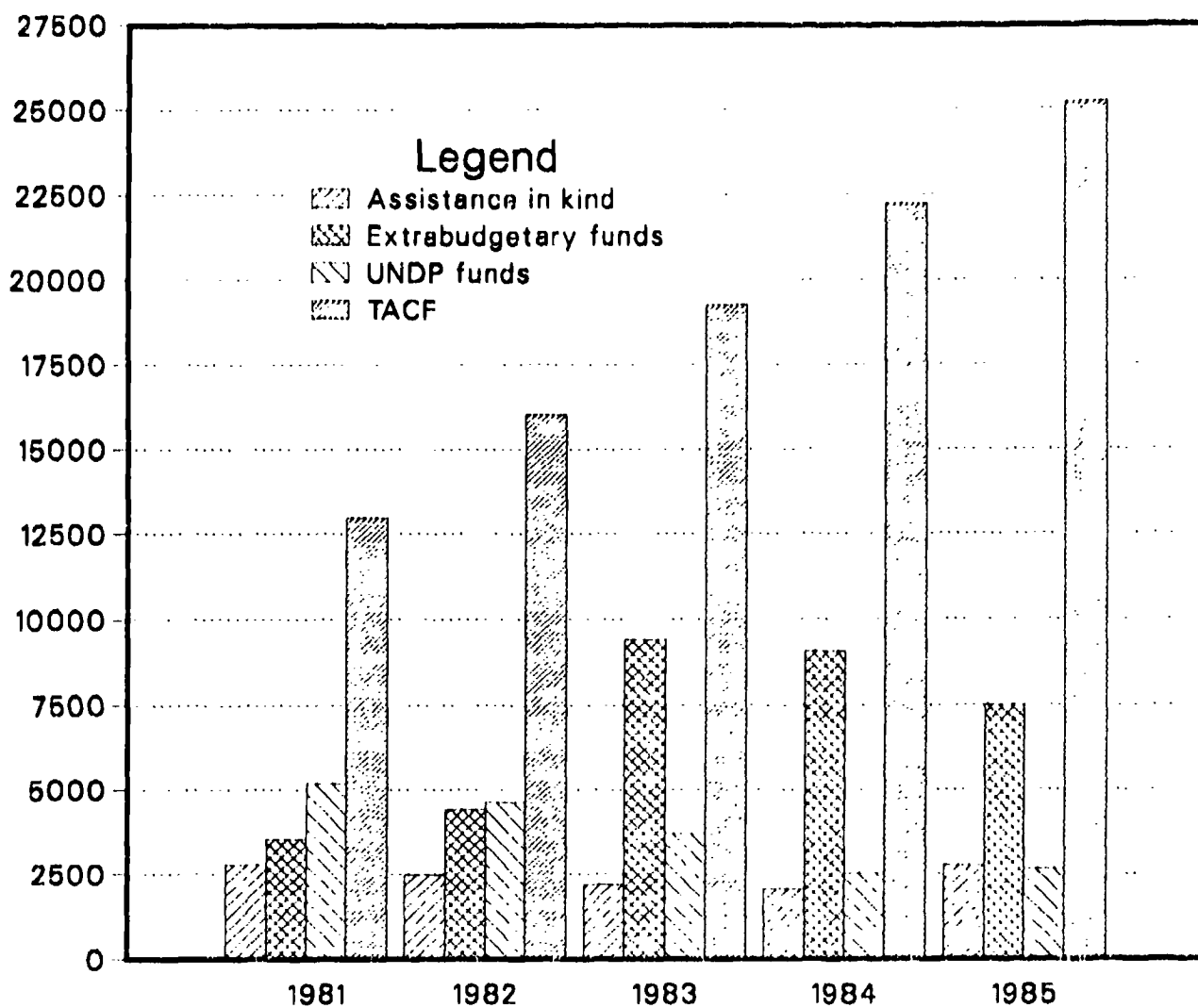
50. **Resource utilization:** In 1985, net expenditure on the delivery of technical assistance reached \$33.7 million, spread over 81 countries and regions (1984: \$32.9 million). The overall net expenditure rate in 1985 was 57.9%, which is slightly lower than the corresponding figure for 1984 (59.3%). However, expenditures from the TACF increased to 66.3% (1984: 65.0%). The utilization rate for extrabudgetary funds, at 35.4%, was lower than in the previous year (44.4%) but higher than in 1983 (31.1%); the lower rate was due largely to difficulties encountered in a large-scale insect pest control project. The UNDP net expenditure rate stood at 76.3%, slightly lower than the rate one year earlier (81.6%). Disbursements on technical co-operation during the period 1981-85 are illustrated in Figure 2.

51. The utilization of resources by fund category during 1985 is summarized in the following table.

Resource category	Adjusted programme (\$)	Net expenditure (\$)	Net expenditure rate (%)
TACF	34 810 179	23 064 817	66.3
Extrabudgetary funds	15 062 658	5 337 690	35.4
UNDP	3 475 903	2 653 512	76.3
Funds in trust	468 737	114 135	24.3

FIGURE 1

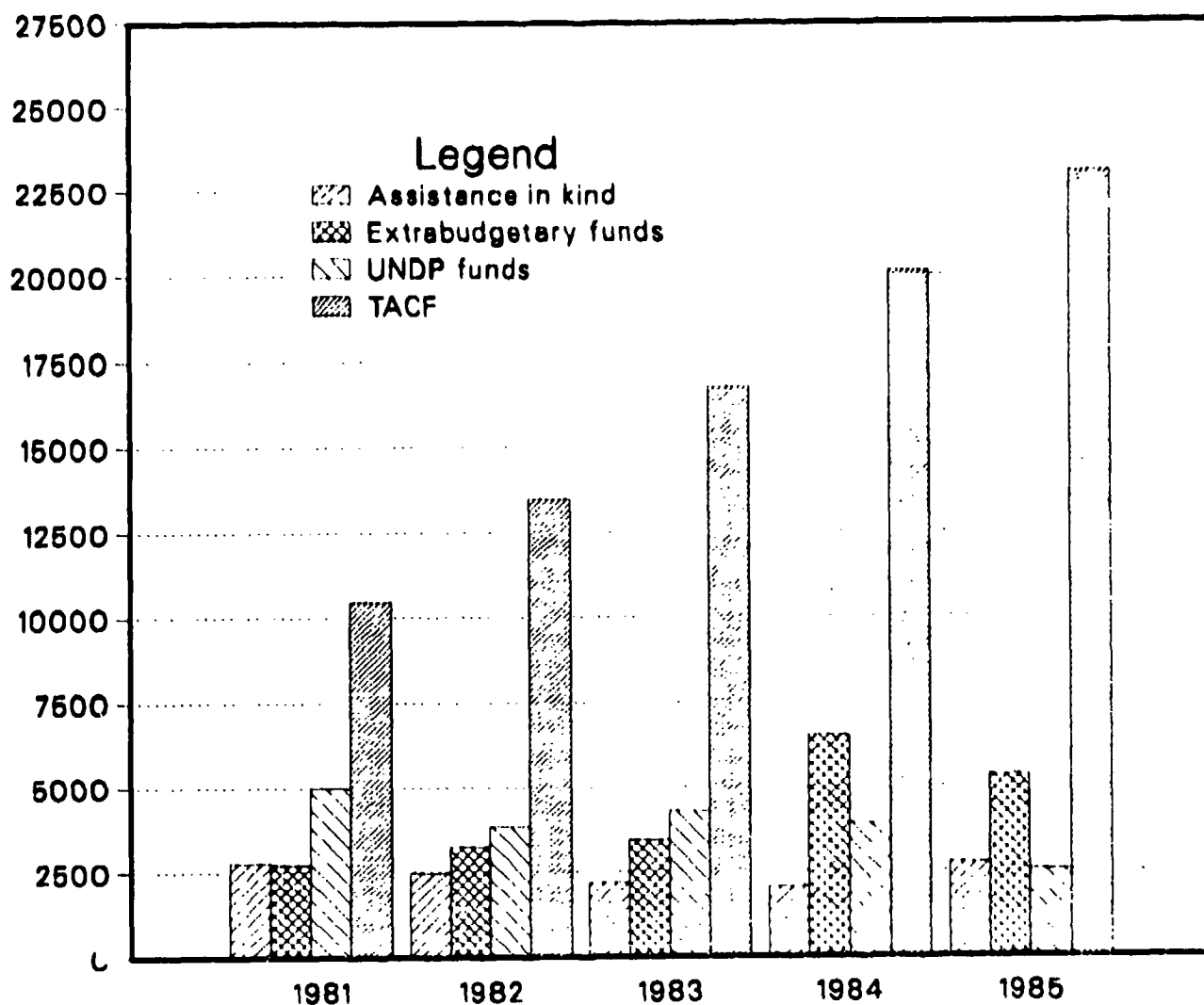
**RESOURCES AVAILABLE FOR
AGENCY TECHNICAL CO-OPERATION PROGRAMMES: 1981 - 1985**
(in thousands of dollars)



TACF	12 956	16 003	19 241	22 232	25 197
Extra-budgetary funds	3 525	4 413	9 394	9 062	7 484
Assistance in kind	2 788	2 493	2 172	2 066	2 765
UNDP	5 186	4 631	3 706	2 541	2 654
TOTAL	24 461	27 540	34 513	35 901	38 100

FIGURE 2

TECHNICAL CO-OPERATION DISBURSEMENTS: 1981 - 1986
(in thousands of dollars)



TACF	10 436	13 451	16 736	20 124	23 062
Extra-budgetary funds	2 742	3 235	3 423	6 493	5 326
Assistance in kind	2 788	2 493	2 172	2 066	2 765
UNDP	4 994	3 827	4 284	3 899	2 563
TOTAL	20 960	23 006	26 615	32 582	33 716

52. The following table shows the utilization of technical co-operation resources by assistance component.

Component	Adjusted programme (\$)	Net expenditure (\$)	Net expenditure rate (%)
Experts	15 090 924	7 695 741	51.0
Equipment	24 862 096	15 855 563	63.8
Fellowships	4 453 787	3 206 482	72.0
Training courses	3 994 200	3 402 912	85.2
Sub-contracts	5 107 505	831 622	16.3
Miscellaneous	308 966	177 844	57.6
Total	53 817 477	31 170 154	57.9

53. The net expenditure rate in the expert component increased from 46.3% in 1984 to 51.0% in 1985; also, there was a 20.7% increase in the number of assignments, following a 39.2% increase in 1984. The trend towards shorter assignments notwithstanding, the number of man-months implemented has increased by 86.3% in the last five years.

54. Disbursements on equipment stood at \$16 million, 7.2% lower than the corresponding figure for 1984. During the last five years, the volume of such disbursements has grown by 62.6%.

55. Although the number of fellows undergoing training in 1985 (615) was significantly below that for 1984 (702), the total man-months of training received fell by only 3.0%, from 3422.5 to 3323 man-months. The number of visiting scientists, which had increased by 89% from 1983 to 1984, increased by another 53% in 1985. During the past five years, the number of fellows increased by 7% and that of visiting scientists by 506%.

56. Sixty training courses and study tours were organized in 1985 as compared with 51 in 1984. While the number of man-months of training provided dropped from 1219.5 in 1984 to 1097.5 in 1985, the number of participants increased from 850 to 926. The man-months of training provided through this assistance component has increased by 55% in the past five years.

57. The Divisions and Departments of the Secretariat which provide the technical backstopping of technical co-operation activities have played their part in coping with the recent rapid growth of the programme. During 1985, 121 technical officers provided support to 833 on-going projects (1984: 770 projects), appraised 642 project requests received from Member States for the 1986 technical co-operation programme (1984: 555 requests), undertook 418 assignments (1984: 378) for a total of 128 man-months and evaluated 926 fellowship applications (1984: 862).

58. **Distribution of assistance:** Table 2 shows disbursements by field of activity and year over the period 1983-85 as a percentage of the total disbursements for those years. As is seen in this table, the overall emphasis of the programme has not changed much, agriculture ranking first, followed by nuclear engineering and technology. Also, as has been the case in the past several years, the share of nuclear materials prospecting continued to decline.

59. How programme emphasis varies from region to region can be seen in Table 3. In 1985, 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 safety in Europe and nuclear materials prospecting in the Middle East.

60. Whereas Figure 3 shows the distribution of assistance by region and resource category in 1985, the following table summarizes assistance provided to each region as a percentage of total disbursements in each of the last three years.

Region	Overall share in %			
	1983	1984	1985	1983-85
Africa	23.2	25.5	20.8	23.1
Asia and the Pacific	32.2	26.7	28.3	28.8
Europe	14.3	11.5	13.1	12.9
Latin America	21.1	24.7	22.6	22.9
Middle East	1.4	0.9	1.6	1.3
Interregional	7.8	10.7	13.3	10.8

61. Africa's and Latin America's shares of the assistance provided in 1985 decreased as compared with 1984, while the shares of Asia and the Pacific, Europe, the Middle East and Interregional increased. The largest relative increase was in the interregional programme.

62. **General observations:** Evaluation is playing an important role in the efforts of the Secretariat to make the Agency's technical co-operation programme more effective. Through the work of the Evaluation Section, a number of problems affecting the quality of the programme were brought to light—including delays in the placement of fellows, the performance of equipment and delays in the provision of expert services—and corrective action was taken. Where patterns of problems common to many projects emerged, the Secretariat initiated efforts to deal with them as general implementation issues instead of waiting for the individual problems to recur.

63. Mid-project and end-of-project evaluations were conducted for 50 projects, and two studies of major processes—covering the provision of equipment and the training course programme—were completed.

64. The contribution of developing countries to the technical co-operation programme has been growing steadily in recent years. In addition to the \$2.3 million pledged by developing Member States towards the TACF target for 1985, \$1.0 million was contributed by these countries in the form of assessed programme costs. The total share of TACF resources made available by such countries was 13.2%.

65. Significant contributions were also made by developing countries to the Agency's training programmes. A total of 33 Type II fellowships valued at \$263 100 and representing 181 man-months of training were provided. Of the 60 training courses held during 1985, 39 took place in developing countries; of the 638 places around the world at which Agency fellows studied, 109 were in developing countries.

66. In 1985, 570 of the 1483 international expert and training course lecturer assignments undertaken were carried out by nationals of developing countries. Moreover, over half of the 'in-kind' experts and 18.0% of the 'in-kind' training course lecturers were from developing countries. The value of in-kind assistance contributed by such countries amounted to \$613 956, or 22.0%.

67. No less important to technical co-operation as a whole are the numerous unquantifiable national inputs of developing countries—in the form of human resources and facilities—which permit the most to be made of the comparatively small inputs provided by the Agency.

TABLE 2. SUMMARY OF DISBURSEMENTS BY FINANCIAL YEAR AND FIELD OF ACTIVITY
(in thousands of dollars)

Field of activity	1983		1984		1985	
	\$	%	\$	%	\$	%
0 - General atomic energy development	2 150.7	8.1	2 770.5	8.5	3 218.7	9.5
1 - Nuclear physics	2 605.6	9.8	3 422.1	10.5	3 809.1	11.3
2 - Nuclear chemistry	911.7	3.4	620.5	1.9	942.0	2.8
3 - Prospecting, mining and processing of nuclear materials	1 676.0	6.3	1 384.1	4.2	1 145.2	3.4
4 - Nuclear engineering and technology	4 377.3	16.5	4 887.8	15.0	4 710.8	14.0
Application of isotopes and radiation in						
5 - Agriculture	4 982.4	18.7	7 904.8	24.3	7 104.3	21.1
6 - Medicine	2 250.8	8.5	2 737.1	8.4	3 178.9	9.4
7 - Biology	302.5	1.1	156.5	0.5	223.0	0.7
8 - Industry and Hydrology	4 153.7	15.6	3 804.3	11.7	4 625.0	13.7
9 - Safety in nuclear energy	3 204.7	12.0	4 775.0	14.6	4 597.5	13.6
Miscellaneous	a/	-	118.8	0.4	161.4	0.5
GRAND TOTAL	26 615.4	100.0	32 581.5	100.0	33 715.9	100.0

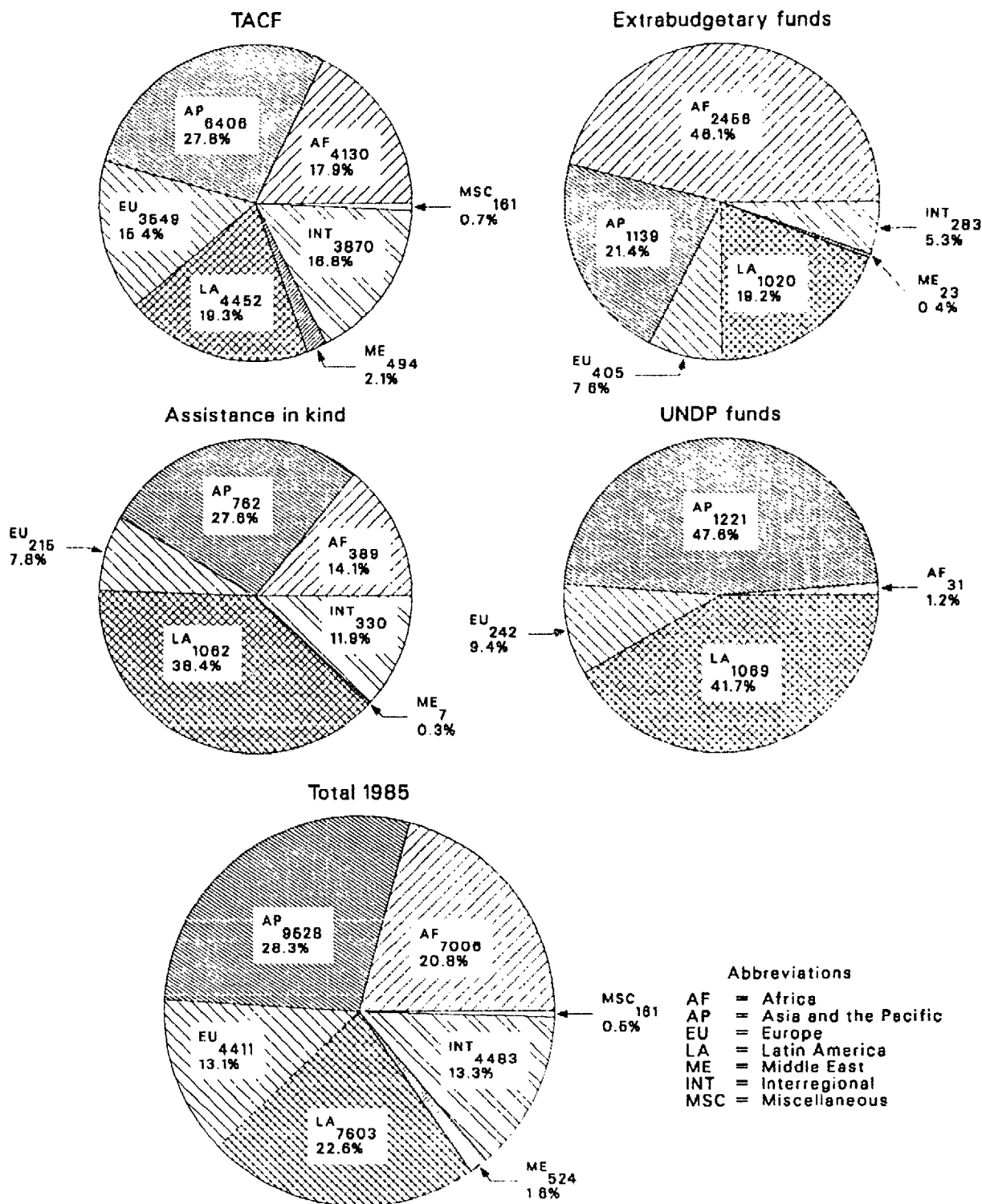
TABLE 3. SUMMARY OF 1985 DISBURSEMENTS BY REGION AND FIELD OF ACTIVITY
(in thousands of dollars)

Field of activity	Africa \$	Asia and the Pacific \$	Europe \$	Latin America \$	Middle East \$	Inter-regional \$	All regions \$
0 - General atomic energy development	656.7	799.7	87.6	1 063.5	123.5	487.7	3 218.7
1 - Nuclear physics	433.5	1 026.5	614.5	853.5	103.1	778.0	3 809.1
2 - Nuclear chemistry	158.9	292.0	227.8	263.3	-	-	942.0
3 - Prospecting, mining and processing of nuclear materials	145.7	116.2	167.0	413.3	146.3	156.7	1 145.2
4 - Nuclear engineering and technology	509.0	1 635.5	840.6	567.3	19.8	1 138.6	4 710.8
Application of isotopes and radiation in							
5 - Agriculture	3 098.7	1 437.0	392.6	1 561.5	10.1	604.4	7 104.3
6 - Medicine	893.0	1 135.4	177.0	664.5	-	309.0	3 178.9
7 - Biology	7.7	108.5	53.3	53.5	-	-	223.0
8 - Industry and Hydrology	456.9	1 840.1	852.5	1 435.1	28.0	12.4	4 625.0
9 - Safety in nuclear energy	645.6	1 137.4	997.8	727.0	93.7	996.0	4 597.5
Miscellaneous	-	-	-	-	-	-	161.4
GRAND TOTAL	7 005.7	9 528.3	4 410.7	7 602.5	524.5	4 482.8	33 715.9

a/ Miscellaneous amounts were pro-rated over the fields of activity for 1983.

FIGURE 3

DISTRIBUTION OF TECHNICAL CO-OPERATION DISBURSEMENTS
BY SOURCE AND REGION: 1985
(in thousands of dollars)



Regional co-operation in Asia and the Pacific

68. In August 1985, China became the 14th Member State to accede to the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA). [2]

69. In September 1985, in conjunction with the 29th session of the Agency's General Conference in Vienna, the 14th meeting of RCA Member States took place. At that time, the report of the seventh meeting of the RCA Working Group—held in March in Pakistan—was reviewed, progress reports were given on active programmes and proposals for new research were discussed.

70. In December 1985, radiation therapy equipment donated by Japan in connection with the RCA co-ordinated research programme on the improvement of cancer therapy was commissioned in Malaysia.

71. The following table provides information on the funds obligated in 1985 by the Agency for 13 active RCA programmes. In addition, in-kind contributions were made by India for a workshop on neutron activation analysis held within the framework of a RCA programme on basic science using research reactors.

[2] See documents INFCIRC/167 and INFCIRC/167/Add.11.

Funds obligated in 1985

Programme	Source of funds				Total
	Regular Budget	Extra-budgetary	TACF	UNDP	
Animal production	51 500	-	-	-	51 500
Food irradiation	-	31 000*	-	-	31 000
Plant breeding					
- Grain legumes	4 094	-	-	-	4 094
- Rice	47 625	-	-	-	47 625
Maintenance of medical instruments	53 589	-	-	-	53 589
Isotope hydrology	-	7 000*	-	-	7 000
Improvement of cancer therapy	-	14 700**	-	-	14 700
Nuclear techniques for tropical parasitic diseases	47 974	-	-	-	47 974
Development of technetium-99m generators	13 933	-	-	-	13 933
Radiation sterilization of biological tissue grafts	24 500	-	-	-	24 500
Imaging procedures for the diagnosis of liver diseases	-	64 100**	-	-	64 100
Toxic elements in foodstuffs	33 200	-	-	-	33 200
Industrial applications of isotopes and radiation technology	-	131 360**	88 138	446 362	665 860
Total	276 415	248 160	88 138	446 362	1 059 075

* Net from cash contributions made by the Government of Australia.

** Net from cash contributions made by the Government of Japan.

NUCLEAR POWER

Energy, electricity and nuclear power planning

72. Activities aimed at helping developing Member States to assess the role appropriate for nuclear power within their national energy plans continued to be emphasized; they included (a) energy and nuclear power planning missions and (b) training courses on electricity system and nuclear power planning:

(a) Planning missions

Agency advisory teams visited Jordan in February, Thailand in March and August, China in April and June, Indonesia in April, August and October, Turkey and Malaysia in August, and Morocco in October. The Agency received visits by members of national counterpart teams from Thailand in January, Indonesia in February and June, and Turkey in May and December. Training in specific aspects of energy and electricity demand analysis was provided at Headquarters to two trainees from Brazil and one trainee from Jordan; and

(b) Training courses

The seventh interregional training course on "Energy planning in developing countries with special attention to nuclear power" was held in Argentina, followed by technical visits in Brazil. A guidebook on energy and nuclear power planning in developing countries (Technical Reports Series No. 245), a comprehensive reference book for this course, was published in March.

The seventh 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 first interregional training course on "Energy demand forecasting for nuclear power planning" - a specialized course, for national energy planners, on the use of the Agency's computer model MAED[3] - was held at the Argonne National Laboratory, United States of America. An advisory group initiated work on a guidebook on energy and electricity demand forecasting for nuclear power planning, which is intended for use as a textbook at future sessions of this training course.

73. An advisory group which reviewed Member States' experience in using the Agency's WASP[4] methodology for the economic optimization of electricity generation systems in developing countries concluded that WASP remains an

[3] MAED: Model for Analysis of Energy Demand.

[4] WASP: Wien (Vienna) Automatic System Planning.

appropriate methodology for the medium- and long-term planning of Member States' electric power systems, including consideration of the role appropriate to nuclear power; at the same time, the group made recommendations for improving the methodology.

74. The Agency continued to co-operate with industrialized Member States and with 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. Within this context, a technical committee on "Energy and nuclear power planning: United Nations and other international organization approaches" met in March.

75. The Agency co-operated with NEA in the preparation of an updated report on "Nuclear energy and its fuel cycle: prospects to 2025" (the "Yellow Book") for publication in the first half of 1986.

76. In August, the Agency published the 1985 edition of the comprehensive overview report on "Nuclear power: status and trends".

77. The booklet "Energy, electricity and nuclear power estimates for the period up to 2000" (Reference Data Series No. 1) was updated using data from the Agency's Energy and Economic Data Bank (EEDB) and Power Reactor Information System (PRIS). Data from EEDB were used in preparing summary data sets for individual countries and for regions; the data sets were issued in October as "Energy and economic tables: 1950-1982".

Manpower and infrastructure requirements and development

78. Work on a series of guidebooks aimed at providing systematic information on infrastructure requirements and development for nuclear power continued. Guidebooks on "Engineering and science education for nuclear power" and "Operating a nuclear power plant in a grid of limited capacity - problems and remedial measures" were completed and a guidebook on "Nuclear power project management" was revised. Work started on guidebooks on "Technician training for nuclear power programmes" and "Research and development support for nuclear power".

79. In the field of training, the emphasis continued to shift towards the organization of courses at training centres in Member States, with the focus on management tools and methods in the planning, construction and operational phases of projects. A seminar and three national courses on project management were held (in the Republic of Korea and Yugoslavia) with the purpose of initiating continuous training in this subject.

80. Two UNDP projects concerned with nuclear power manpower development (one in Argentina and one in the Philippines) were supported, and programing missions for a major UNDP project on nuclear power manpower development in China were carried out.

81. Under the Agency's regular programme of technical co-operation, there was a continued increase in emphasis on infrastructure planning and feasibility studies and on operational support areas such as in-service inspection and control system updating; 31 country projects in 18 Member States and an interregional project aimed at co-ordinating support in the early stages of nuclear power projects were serviced. Agency staff members provided advice on feasibility studies and project planning and management through missions to Morocco (two), Turkey, Uruguay and Yugoslavia.

Small and medium power reactors (SMPRs)

82. The first phase of the SMPR project initiation study was concluded with the publication of a report which clearly shows the interest of suppliers in providing nuclear power plants in the range below 600 MW(e). Some ten developing countries were identified as potentially able to accommodate SMPRs in their grids, but these countries would undoubtedly require additional assurances of the economic viability of SMPRs before embarking on a project.

83. The positive experience with SMPR projects in Member States was highlighted in the scientific afternoon held during the 1985 session of the General Conference; in addition, a technical committee meeting was held at that time in order to inform delegations from developing Member States about the results of the SMPR study. A proposal was made for a second phase of the study, to start in 1986, with considerable emphasis on country-specific studies aimed at providing more accurate information on the constraints and economics of introducing SMPRs.

Technical performance of nuclear power

84. In co-operation with the Statistical Office of the European Communities and UNIPED, the Agency made changes in the data reporting formats of PRIS[5] so as to ensure as far as possible that duplication of work by plant operators is avoided and that reporting is consistent; the CEC now collects the data for reactors in its member countries, and "availability to produce energy" is now used rather than "load factor" as a performance indicator.

85. The main conclusions drawn from analyses of PRIS data performed in 1985 were that power reactor performance is much less a function of plant type or supplier than of the degree of plant standardization, the quality assurance standards used, the regulatory climate and the competence of the operating organization.

86. The increase in the number of specific data sets requested by PRIS participants continued, with more than 30 requests, mainly from utilities or related organizations, being dealt with during 1985.

87. The production time for the annual report "Operating experience with power reactors in Member States", which is determined by the timeliness of data transmission from Member States, was reduced and steps were taken with a view to achieving a further reduction.

88. Data in PRIS were used in preparing a number of papers published in international journals or presented at an Agency symposium on "Advances in nuclear power plant availability, maintainability and operation". The symposium, held in Munich, Federal Republic of Germany, highlighted the high or improved plant availabilities which have been attained in several countries and showed that this is an operational trend due not to improvements in plant design but to better maintenance, the reduction of failure rates and a general improvement in the quality of all activities associated with plant operation.

89. The International Working Group (IWG) on the Reliability of Reactor Pressure Components met to plan future activities in the context of national

[5] By the end of 1985, PRIS contained information covering more than 2800 reactor-years of operation and 17 600 outages.

research and development programmes. A co-ordinated research programme on the optimization of pressure vessel surveillance programmes was launched with participants from 17 countries. A specialists' meeting on "Subcritical crack growth" was held in Japan and one on "Recent trends in primary circuit technology" was held in Spain.

90. In the field of nuclear power plant control and instrumentation, a co-ordinated research programme on "Modelling approaches for training simulators" was launched with participants from eight countries. A specialists' meeting on "New instrumentation for water-cooled reactors" was held in the German Democratic Republic and one on "Load following control of nuclear power plants" was held in India.

Quality assurance and control (QA/QC)

91. The NUSS code and guides on QA having been completed in 1984, the focus turned towards the provision of assistance - partly through manuals - in the application of these basic regulatory documents. In 1985, two manuals ("Training, qualification and certification of QA personnel" and "QA for surveying, evaluation and certification of nuclear power plant sites") were completed and two ("QA for computer software" and "QA for control and instrumentation") were initiated.

92. Two interregional courses on QA were organized, one in Argentina and one in the Federal Republic of Germany. Initial national courses were organized for the Islamic Republic of Iran, the Republic of Korea, Turkey and Yugoslavia.

93. Agency staff provided QA advisory services through missions to Indonesia, the Philippines and Turkey. Seven technical co-operation projects on QA subjects were supported.

Economic performance of nuclear power

94. In September, at an Agency seminar on the costs and financing of nuclear power programmes in developing countries, which was attended by some 80 participants from 29 Member States (including 18 developing countries) and seven organizations, the participants concluded that the Agency could help to provide commercial lenders with a better flow of information on the technical provenness of nuclear power and on the specific financial requirements of nuclear power projects, which are quite different from those of other industrial projects. Also, they recommended that the Agency broaden the scope of its assistance to developing Member States, by providing information on financing techniques and by promoting feasibility studies which could lead to improvements in the appraisal of the financial risks associated with nuclear power projects. It was felt that the Agency's involvement in financial feasibility studies would carry considerable weight with lenders and export credit agencies.

95. Work was completed on revising - for publication during 1986 - the Agency's Guidebook on the Economic Evaluation of Bids for Nuclear Power Plants and on writing a microcomputer program - for distribution as an annex to the revised guidebook - to assist in performing the economic calculations.

96. Substantial progress was made, with the help of a consultant, in preparing a guidebook on bid invitation specifications for nuclear power

plants. Agency advisory teams visited Yugoslavia to assist in the preparation of nuclear power plant bid invitation specifications and China to advise on the evaluation of bids for a nuclear power plant.

97. Consultants from a bank in France assisted the Agency in designing a financial analysis model to be used on microcomputers in, among other things, subjecting WASP-derived optimum expansion plans to an analysis of their impact on various financial indices of electrical utilities. During 1986 this model is being tested as part of an energy and nuclear power planning study in a developing Member State.

98. The costs and benefits of nuclear power plant performance improvements were considered by an advisory group which recommended that the Agency promote the development and assist in the transfer of a systematic and quantitative methodology for availability management - including elements such as engineering for reliability and availability management, the feedback of experience to operators, vendors and regulatory authorities, life cycle cost evaluation, and preventive maintenance strategies.

Low-temperature heat applications

99. A report on "Nuclear heat applications" was published, and an advisory group meeting on the "Potential of low-temperature heat applications" was held, in Switzerland, against a background of increasing general interest - due especially to the construction of district heating plants now under way in the Soviet Union and to the success of specific dual-purpose applications in countries such as Czechoslovakia and Switzerland.

Fission reactor systems

100. The IWG on Fast Reactors reviewed the progress of LMFBR programmes - especially in Eastern and Western Europe, India, Japan and the United States - and organized specialists' meetings on three topics relating to the operational safety and availability of fast reactors: heat and mass transfer in cover gas, cavitation design criteria and LMFBR fuel behaviour during operational transients.

101. An Agency symposium on experience with fast breeder reactors and prospects for the future was held during July in Lyons, France, on the occasion of the startup of the world's largest commercial fast breeder reactor, Super Phénix. A technical report on the status of fast reactors worldwide was published to coincide with the symposium.

102. Satisfactory progress was made during the first year of two co-ordinated research programmes, one on "Sodium boiling noise detection" and the other on "Future applications of advanced reactors". A co-ordinated research programme entitled "Intercomparison of core mechanics codes" was initiated.

103. The IWG on Gas-Cooled Reactors reviewed trends in national development programmes and organized specialists' meetings on gas-cooled reactor safety and accident analysis and on fission product release and transport; particular emphasis was placed on reviewing the inherent safety features of small gas-cooled reactors and the behaviour of such reactors under accident conditions. Preparatory work started on a technical report on the safety characteristics of gas-cooled reactors.

104. The Agency published a technical document on improved light- and heavy-water reactor concepts for better fuel utilization which identifies further development needs in this area.

105. An advisory group meeting initiated an Agency programme on new water reactor concepts aimed at simpler operation, improved plant safety and reduced construction and operation costs.

106. Additional assistance was provided to Mexico in the use of computer programs for in-core fuel management at the nuclear power plants under construction there.

Nuclear fusion

107. A technical committee considered the implications of life-limiting effects for the stability of first-wall and blanket structure materials to be used in fusion reactors and various approaches to predicting the lifetime of such materials.

NUCLEAR FUEL CYCLE

Uranium resources and production

108. The near-term outlook for uranium is one of over-supply and low prices, as in the past few years. Uranium production in WOCA[6] countries, which had been close to 39 000 tonnes in 1984, well above the requirements in that year, fell to about 37 000 tonnes in 1985, the first year since the commercial introduction of nuclear power generation, in the mid-1960s, that uranium production was below reactor-related requirements (estimated at around 39 000 tonnes of uranium in 1985). The continuing over-supply situation was due largely to the existence of uranium inventories estimated to be equivalent to three-four years of reactor-related requirements.

109. In 1984 (the latest year for which reliable figures are available at present), the average delivery price of domestic and imported uranium fell by about \$17/kg to \$73/kg in the United States and by about \$3/kg to slightly over \$77/kg in the EEC area. Spot market prices fell from \$40/kg at the end of 1984 to a low of \$38/kg in mid-1985, recovering to about \$44/kg towards the end of 1985.

110. As a consequence of the low prices, uranium exploration continued to decline in WOCA countries, where the exploration expenditure level in 1979 (the peak year) was \$740 million. Total exploration expenditures declined in 1984 by about one third from the 1983 level, to \$144 million, but planned 1985 expenditures (about \$120 million) represented a decrease of only 13%. In this connection, it may be noted that many developing countries continued to intensify their exploration efforts.

111. Since 1982 there has been a shift in the geographical distribution of uranium production. For example, the United States was the leading uranium-producing WOCA country through 1983, but in 1984 uranium production in the United States was at only about 70% of the 1983 level, the share of WOCA production attributable to the United States having dropped from 22% to 15%. In the same period, Canada increased its share from 19% to 29%, becoming the leading WOCA producer in 1984.

112. The Agency - in collaboration with NEA - continued preparing a new edition of the publication "Uranium - Resources, Production and Demand" (the "Red Book") for release in 1986. In a further effort to improve data input to the Red Book, a group of consultants met to consider long-term uranium supply and demand and another group began preparing a manual on the appraisal of undiscovered uranium resources. An "Instruction Manual on Methods for the Estimation of Uranium Ore Reserves" (Technical Reports Series No. 255) was published.

113. In the area of uranium geology, a report on "Uranium Deposits in Volcanic Rocks" and a technical document on "Geological Environments of Sandstone Type Uranium Deposits" were released. Work on a report concerning the correlation of uranium geology between South America and Africa was completed and work on one concerning uranium deposits in proterozoic quartz pebble conglomerates neared completion.

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

114. The Agency convened a technical committee on "Recognition of uranium provinces" in London, United Kingdom, and one on "Uranium deposits in Asia and the Pacific; geology and exploration" in Jakarta, Indonesia.

115. An advisory group on uranium exploration and regional evaluation reviewed the present status of uranium exploration techniques and the Agency's past, present and planned activities in this field. Emphasis was placed on: the needs of developing Member States for exploration techniques appropriate to their environments; the importance of increasing the R&D work being done on such techniques; the Agency's role in information gathering and dissemination; and the need to preserve geological and exploration data in danger of being lost during the current period of diminished uranium exploration activity.

116. A technical document entitled "Uranium biogeochemistry: a bibliography and report on the state-of-the-art" was published and manuals entitled "Practical borehole logging procedures, with emphasis on uranium" and "Manual of geochemical exploration for uranium" were prepared for printing. Work continued on a manual on the use of radon in uranium exploration. A group of consultants began preparing a manual on the construction and use of calibration facilities for radiometric field instruments.

117. The preparation of uranium, potassium and thorium reference materials for use in laboratory gamma-ray spectrometric analyses of geological samples continued, the aim being to distribute the set of three reference materials by mid-1986.

118. Data on some 2000 uranium occurrences were added to the International Uranium Geology Information System (INTURGEO), bringing to about 3600 the total number of occurrences described. Mailings of INTURGEO data were made to Member States for checking and in order to obtain missing data. Advisory groups recommended a greater Agency effort in the uranium geology information area. In 1985, considerable progress was made towards the near-term goal of a world atlas of uranium deposits and occurrences.

119. In the light of recommendations made by a group of consultants on long-term uranium supply, the Agency upgraded its Resource and Production Projection (RAPP) computer model, which is used in analysing data on production capabilities, reasonably assured resources, estimated additional resources and the speculative resources. Analyses of data with the help of the RAPP model indicated that additional uranium production capabilities will be required as from the mid-1990s in order to meet even low uranium demand scenarios.

120. MICROGAS, a microcomputer-based statistical analysis package for geochemical data, was provided to Costa Rica and Portugal, and computer-assisted mapping programs and documentation were provided, together with modifications of MICROGAS, to Yugoslavia.

121. Last year, 42 technical co-operation projects in 30 countries were supported. A training course on exploration drilling and ore reserve estimation was held in Brazil.

Processing and production of nuclear and reactor materials

122. The proceedings of technical committee meetings on "Advances in uranium ore processing and recovery from non-conventional resources" and on "Inorganic

ion exchangers and adsorbents for chemical processing in the nuclear fuel cycle" were issued, and the draft of a manual on "Laboratory evaluation techniques for uranium ore processing" was prepared for publication in 1986. The third and last newsletter on "R&D in Uranium Extraction" was issued jointly by the Agency and NEA. The draft of a technical document on "Ion-exchange technology in the nuclear fuel cycle" was completed.

123. A technical committee on the development of projects for the production of uranium concentrates addressed - for the first time within the framework of the Agency - the problems of planning and implementing a complete uranium mining and ore processing project, from the evaluation of ore reserves through to processing plant startup.

124. The draft of a report based on information from the Nuclear Fuel Cycle Information System, which covers facilities for uranium refining and conversion, enrichment, fuel fabrication, the production of heavy water and the production of Zircaloy tubing, was prepared with a view to the publication of a final report in 1986.

125. Technical assistance in the field of uranium ore processing was provided to five countries during 1985.

Fuel performance and technology

126. In September, the IWG on Water Reactor Fuel Performance and Technology discussed results obtained during the previous two years in 20 countries in the production of water reactor fuel or the investigation of its performance and advised the Secretariat regarding the Agency's programme for the years 1987-88. It recommended that the Agency focus on studies of water side corrosion, pellet/cladding interactions, fission gas release, dimensional quality assurance and quality control in fuel fabrication and that emphasis be given to developing improved fuel design and utilization approaches aimed at meeting the demands on fuel elements arising from efforts to increase burn-up rates and improved load-following performance.

127. A technical committee meeting on "External cladding corrosion in water power reactors" was held at Cadarache, France, and one on "Fuel rod internal chemistry and fission product behaviour" was held at Karlsruhe, Federal Republic of Germany. The proceedings of a technical committee meeting on "Post-irradiation examination and experience" were published.

128. Work continued under three co-ordinated research programmes. The results of a co-ordinated research programme on fuel element cladding interactions with water coolant in power reactors were discussed at an expert group meeting at Cadarache, France, and a survey report on this subject was released as a technical document; internal reports were prepared on analytical methods for monitoring water chemistry and on the modelling of corrosion product behaviour and crud build-up in PWR and BWR circuits.

129. Data on the post-irradiation examination of water reactor fuel in storage pools and hot cells and approaches to the unification of experimental methods for post-irradiation examination were reviewed at a research co-ordination meeting in Vienna.

130. Work continued on developing computer models for studying the behaviour of fuel elements in water reactors, the aim being to finalize it in 1985.

131. The Agency continued to collect data on fuel fabrication facilities for entry into the Nuclear Fuel Cycle Information System.

132. The proceedings of an advisory group meeting on advanced fuel technology and performance held in 1984 were published last year as an IAEA technical document. A technical committee meeting on "Utilization of thorium-based fuel: current status and perspectives" was held in Vienna in December.

133. During 1985, six technical co-operation projects relating to reactor materials and fuel production were supported.

Spent fuel management

134. IAEA technical documents entitled "Status of spent fuel dry storage concepts" and "Status of LWR rod consolidation for storage purposes" were issued in 1985; also issued was a "Glossary of terms related to spent fuel storage" (English version; the Russian version was due to be issued in 1986 and the French and Spanish versions in 1987).

135. A questionnaire on dry and wet storage experience was distributed to Member States in July as the first step in the preparation of a survey report scheduled to be issued in 1987.

136. A technical committee on methods used in the design of wet and dry spent fuel storage facilities held in Espoo, Finland, considered design and safety aspects of wet and dry storage facilities, ways of improving storage system designs on the basis of existing operational experience, and economics, licensing and regulatory aspects of spent fuel storage facilities.

137. Under the co-ordinated research programme on the behaviour of spent fuel assemblies during extended storage (known as the "BEFAST" programme) important information concerning the integrity of fuel cladding and the operational reliability of storage facilities was obtained and analysed. The first draft of the final programme report was prepared in December.

138. In the area of spent fuel treatment, an IAEA technical document entitled "Status of treatment of LWR fuel" was issued.

139. A group of consultants surveyed the development status of structural materials for nuclear fuel cycle equipment and recommended the holding of a technical committee meeting on materials experience at the back-end of the nuclear fuel cycle in 1986.

Handling, treatment, conditioning and storage of radioactive wastes

140. The 16th annual edition of "Waste Management Research Abstracts" (containing over 600 abstracts from 33 countries) and a report on the management of wastes produced by users of radioactive materials (Safety Series No. 70) were published.

141. A training course on radioactive waste management was held at Saclay, France.

142. A code of practice on the management of radioactive waste from nuclear power plants (Safety Series No. 69) was issued. The preparation of a safety

guide on the design of low- and intermediate-level liquid and solid waste treatment facilities at nuclear power plants was completed.

143. Reports on the treatment of spent ion-exchange resins for storage and disposal (Technical Reports Series No. 254), on the chemical durability and the related properties of solidified high-level waste forms (No. 257) and on the management of cladding hulls and fuel hardware (No. 258) were published. The preparation of reports on techniques and practices for the pretreatment of low- and intermediate-level waste and on the design of off-gas and air cleaning systems for nuclear power plants was completed. Work continued on reports dealing with the handling and treatment of radioactive waste from unplanned events at nuclear power plants, with the design and operation of off-gas cleaning systems for high-level liquid waste conditioning facilities, and with the treatment, conditioning and disposal of iodine-129.

144. A research co-ordination meeting was held on the performance of solidified high-level waste forms and engineered barriers under repository conditions. A co-ordinated research programme on the retention of iodine and other airborne radionuclides during abnormal and accident conditions continued and one on the evaluation of low- and intermediate-level radioactive solid waste forms and packages was initiated. The final report of a co-ordination research programme on high-efficiency particulate filter testing methods was published as an IAEA technical document.

Decontamination and decommissioning

145. A report on the decontamination of nuclear facilities to permit operation, inspection, maintenance, modification or plant decommissioning was issued (Technical Reports Series No. 249) and the preparation of one on the methodology and technology of decommissioning nuclear facilities was completed. A technical committee reviewed methods of reducing occupational exposures during the decommissioning of nuclear facilities.

146. A co-ordinated research programme on the decontamination and decommissioning of nuclear facilities continued.

147. Draft documents on the decontamination and demolition of concrete and steel structures and on the technology, safety and economics of recycling materials arising from the decommissioning of nuclear facilities were prepared by consultants.

Underground disposal of radioactive wastes

148. Twenty-four reports and the proceedings of two symposia were published within the framework of the integrated underground waste disposal programme launched in 1977. Reports relating to the disposal of radioactive wastes in shallow ground and rock cavities were completed.

149. An advisory group reviewed international standards and criteria for the underground disposal of high-level wastes. The code of practice - and the guide to the code - on the management of wastes from the mining and milling of uranium and thorium ores (Safety Series No. 44, issued in 1977) was revised and the revised texts sent to Member States for comment.

150. Safety Series reports on performance assessment for underground radioactive waste disposal systems (No. 68) and acceptance criteria for the

disposal of radioactive solid wastes in shallow ground and rock cavities (No. 71) were published.

151. Reports on operational experience with the shallow ground disposal of radioactive wastes (Technical Reports Series No. 253), site investigation techniques for the underground disposal of radioactive wastes (No. 256) and near field effects in the deep underground disposal of radioactive wastes (No. 251) were issued.

152. Draft reports on in situ experiments relating to the disposal of radioactive wastes in deep geological formations and on acceptance criteria for the disposal of radioactive wastes in deep geological formations were prepared by consultants.

Sea dumping and releases of radioactive effluents

153. Revision of the IAEA definition of radioactive material unsuitable for dumping at sea (set out in Agency document INFCIRC/205/Add.1/Rev.1) was completed.

154. Reports on sediment distribution coefficients and concentration factors for radionuclides in the marine environment (Technical Reports Series No. 247) and methods for assessing the radiological impact of radionuclides dispersed on a regional or global scale (No. 250) were issued; also issued was an IAEA technical document on the behaviour of radionuclides released into coastal waters.

155. A group of senior experts in radiation protection and waste management reached a consensus on principles for the exemption of radiation sources and practices from regulatory control (see para. 159); the meetings of the experts were organized by the Agency in co-operation with NEA and WHO. Preparations were made for the publication of a Safety Series document on the subject in 1986.

156. In the area of radiological assessment, procedures for estimating the reliability of predictions based on environmental transfer models were reviewed and a report on models for predicting the atmospheric dispersion of radionuclides from the nuclear fuel cycle was finalized.

157. A co-ordinated research programme on the role of sediments in the transport and accumulation of radioactive pollutants in rivers and estuaries and one on the environmental migration of radium and other contaminants present in solid and liquid wastes from the mining and milling of uranium were completed in 1985. As a follow-up to the latter programme, work on producing a monograph on the environmental behaviour of radium was initiated. A co-ordinated research programme on the migration and biological transfer of radionuclides from shallow land burial was also initiated.

Radiation protection

158. Work continued to focus 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, for operational radiation protection and for radiation monitoring. The preparation of documents on the safe use of industrial radiation sources, the provision of radiation protection services at nuclear power plants and procedures for the systematic appraisal of radiation protection programmes was initiated. An intercomparison programme for personnel dosimeters was designed.

159. The proceedings of a 1984 symposium, organized by the Agency in co-operation with WHO, on the assessment of radioactive contamination in man were published. A technical report on neutron monitoring was issued and a guide on the principles for establishing rules for the exemption of radioactive material from notification, registration and licensing was prepared (see para. 155).

160. Recommendations were published on a minimum value to be assigned to the unit collective dose for transboundary exposure. A major revision was completed of Safety Series No. 45, "Principles for limiting releases of radioactive effluents into the environment". Guidelines were elaborated on methods for assessing individual and collective doses from releases of radioactive effluents, on the application of the principles for limiting radioactive releases from specific sources and on monitoring principles and methodologies for the radiation protection of the general public. The question whether and how the principles laid down in the Basic Safety Standards can be extended to sources of potential exposure such as radioactive waste repositories was examined.

161. The results of a co-ordinated research programme on radioactive material in the Baltic Sea were published. A co-ordinated research programme on carbon-14 from nuclear facilities continued.

162. A total of 89 technical co-operation projects concerning radiation protection were handled and 18 missions (including four RAPAT missions and seven health and safety missions to research reactor installations) visited developing Member States. Fellowships in the field of radiation protection were arranged for 62 persons from developing countries. Courses forming part of a long-term training programme in radiation protection were held in Argentina and India, and preparations were made for a training course to be held in Arabic. A workshop on radiation protection and a technical meeting on radiation protection in medical practices were organized within the framework of ARCAL.

163. The Regulations for the Safe Transport of Radioactive Material (Safety Series No. 6) were published in English, French and Spanish, and supporting documents containing explanatory and advisory material were prepared. A co-ordinated research programme on the safe transport of radioactive material was concluded, and guidelines were prepared on optimizing radiation protection during transport and on evaluating the radiological impact of the transport of radioactive materials. Training in the safe transport of radioactive material was provided in China through a training mission.

164. A symposium on emergency planning and preparedness for nuclear facilities, held in Italy, showed that over the previous seven years progress had been made, particularly in the field of computerized accident assessment technology which the Agency is helping to transfer to developing Member States with nuclear power programmes.

165. In line with its standing offer to send missions to requesting Member States for the purpose of assisting in the establishment and improvement of emergency plans and related emergency preparedness arrangements, the Agency sent a mission to Denmark and Sweden to assist in a review of an exercise aimed at assessing the effectiveness of the emergency preparedness arrangements established in those two countries in order to provide against an accident at the Barsebäck nuclear power station in Sweden. Two observers from developing Member States accompanied the Agency team, thereby gaining experience in the preparation, implementation and assessment of large-scale nuclear power plant emergency exercises.

166. Guidelines on reportable events, integrated planning and information exchange in the event of transboundary releases of radioactive materials were published. Safety Series documents giving guidance on principles for the establishment of intervention levels and on the preparation, evaluation and conduct of emergency exercises were also published. Documents giving guidance on accident assessment, post-accident assessment and recovery operations, on emergency response facilities and derived intervention levels were completed for publication. Work continued on the maintenance of on-site habitability during an accident at a nuclear installation and on the production of a training film on emergency planning and preparedness.

167. Activities relating to the establishment of guidelines on the assessment and treatment of radiation injuries continued. The development and adoption of new methods for biological dosimetry were supported through a co-ordinated research programme. A technical document on the use of chromosomal aberration analysis for dose assessment was completed. A publication with basic information on assessment and first aid treatment following the accidental irradiation or contamination of medical doctors in general practice was prepared. Activities were initiated in support of the establishment or improvement of radiation protection in the medical uses of ionizing radiation in radiodiagnostics, radiotherapy and nuclear medicine. A co-ordinated research programme involving the use of a realistic chest phantom in studying the deposition of plutonium in lungs was extended to include other radionuclides, in particular depleted and enriched uranium.

Physical protection of nuclear facilities and materials

168. The sixth international training course on the physical protection of nuclear facilities and materials, held in Albuquerque, United States of America, was attended by 25 participants from 17 Member States.

Radiation protection service

169. Personnel monitoring services continued to be provided on a routine basis for the Agency's radiation workers, for technical co-operation experts and for trainees from Member States.

170. Personnel thermoluminescence dosimetry services were provided for five countries where such services are not yet available locally: Ethiopia, Mali, Nigeria, Sierra Leone and the United Republic of Tanzania.

171. Missions visited Jordan, Kenya and Mali to advise on the establishment of national radiation protection services, and Algeria, Bolivia, Morocco and Tunisia in connection with technical assistance projects.

172. Training in radiation protection was given to ten fellows - from Ecuador, Ethiopia, Guatemala, the Islamic Republic of Iran, the Libyan Arab Jamahiriya, Sudan, Thailand and the United Republic of Tanzania. Six of them also participated in a 17-week introductory course on radiation protection services held in Vienna.

Risk assessment

173. With the participation of 12 developing Member States, an interregional technical co-operation project was initiated for the purpose of building up probabilistic safety analysis (PSA) teams. Information continued to be provided on the use of PSA in safety decision-making.

174. A joint Agency/ILO/UNEP/WHO project on assessing, controlling and managing the health and environmental risks of energy and other complex industrial systems was initiated.

Safety of nuclear installations

175. OSART reviews were conducted in four countries (Brazil, France, Pakistan and the Philippines). France was the first developed country to receive an OSART mission, of which there are now two types:

- (a) Missions to developing countries for the purpose of providing an operational safety review service; and
- (b) Missions to advanced countries for the purpose of training review participants from developing countries.

176. Missions visited Finland and Mexico in order to prepare OSART reviews scheduled for early 1986.

177. The International Nuclear Safety Advisory Group (INSAG) set up by the Director General held its first two meetings; the issues discussed included the source term, incident information feedback, the human element, safety goals and quality assurance. An INSAG sub-group prepared a draft position paper on the source term with technical support from the Agency's Secretariat. With regard to incident information feedback, INSAG made recommendations concerning feedback expansion and additional services which the Agency might provide to Member States.

178. An Agency/NEA meeting was held in September to review lessons from significant incidents reported to the Agency's incident reporting system (IRS), which is now receiving input from 22 countries.

179. Work on the 60 documents (codes and guides) envisaged in the Nuclear Safety Standards (NUSS) programme was completed and activities aimed at helping Member States to implement the NUSS documents (for example, the organization of training courses and the production of supporting manuals) were intensified.

180. A symposium on source term evaluation for accident conditions, held in the United States with participants from 30 countries (including ten

developing countries), discussed the thermodynamic, physical and chemical processes considered in source term evaluations and the most recent scientific and technical developments in this area.

181. Over 30 experts from five developing countries spent on average four weeks each at the Agency's Headquarters performing safety analysis calculations with the help of computer codes developed in advanced countries such as the United States and the Federal Republic of Germany. A workshop held at Portoroz, Yugoslavia, discussed participants' experience in using such safety analysis codes.

182. In the belief that not only computer codes but also modelling techniques should be assessed, the Agency initiated, in co-operation with the Central Physics Research Institute of the Hungarian Academy of Sciences, a "standard problem exercise" involving the pre-test calculation of a medium-size loss-of-coolant experiment to be conducted on a scaled-down model of a WWER-440 reactor. Twenty-five technical groups in 14 countries expressed interest in participating in the exercise.

183. Research reactor safety missions visited Egypt, Pakistan, Turkey, Viet Nam and Yugoslavia, where seven installations were reviewed. Two research reactor safety documents (one dealing with probabilistic safety analysis and one with siting) were completed.

184. At a seminar on the backfitting of nuclear facilities held in Munich, Federal Republic of Germany, emphasis was placed on the question of how decisions to modify facilities are justified in the light of the costs involved.

185. Support was provided for 85 technical co-operation projects concerning nuclear power plant siting, regulatory processes, safety analysis, licensing and other aspects of nuclear safety.

Soil fertility, irrigation and crop production

186. Assistance to Member States continued through 58 research contracts and agreements and 51 technical co-operation projects.

187. Work continued under a co-ordinated research programme aimed at maximizing crop yields in multiple cropping systems through the increased utilization of atmospheric nitrogen, rather than expensive nitrogen fertilizers, nitrogen-15 labelling techniques being used in assessing nitrogen fixation. Both agronomic and genetic factors were studied under another programme with a view to increasing nitrogen fixation in legumes and legume yields.

188. Isotope techniques were employed in assessing the release of nitrogen from the fern *Azolla* used as biofertilizer in rice paddies, and studies continued on management practices that would enhance the value of *Azolla* for paddy rice. Isotope techniques were also employed in evaluating the usefulness of rock phosphate as a source of phosphorus for plant growth.

189. With high soil salinity affecting very extensive areas of cultivable land in different parts of the world, isotope- and radiation-aided studies of agronomical practices which would promote plant growth on saline soils and increase crop yields were initiated, the emphasis being on increasing biological nitrogen fixation and fertilizer and water use efficiency and selecting crop varieties tolerant to salinity with the help of mutation induction and in vitro technology.

190. Two training courses on the use of isotopes and radiation techniques in studies of soil-plant relationships were organized at the Agency's Agricultural Laboratory at Seibersdorf, Austria, with the help of the Austrian Government. An interregional training course held in Leipzig, German Democratic Republic, covered the use of nitrogen-15 techniques in agricultural biotechnology, with special emphasis on soil-plant nitrogen studies and nitrogen fixation.

Plant breeding and genetics

191. Assistance to Member States' plant breeding programmes continued through 101 research contracts and agreements and 25 technical co-operation projects.

192. New, improved crop varieties in farmers' fields obtained from induced mutations and the use of mutants in cross-breeding were reported from Austria, Brazil, Canada, China, Czechoslovakia, France, India, Indonesia, the Republic of Korea, Poland, Sweden and the United States. In China alone there are 8.7 million hectares of land under radiation-induced mutant crops, and the annual value of the wheat and cotton crops obtained with improved mutants is estimated at \$700 million.

193. A scientific meeting on rice breeding was held at Katsuta, Japan, one on the genetic vulnerability of cereals was held in Rome, Italy, and one on the use of in vitro techniques was held in Vienna - in conjunction with the first FAO/IAEA symposium on nuclear techniques and in vitro culture for plant improvement.

194. The fourth FAO/IAEA interregional training course on the induction and use of mutations in plant breeding was held at Seibersdorf and a mutation breeding training course organized specifically for plant breeders from ARCAL countries was held at Piracicaba, Brazil. In addition, 23 scientists were given individual training in mutation breeding under the Agency's fellowship programme.

195. The FAO/IAEA programme at Seibersdorf focused on the development of an in vitro methodology for the mutation breeding of crops relevant to developing countries - such as banana, plantain, cocoa, cassava and yam.

Animal production and health

196. Assistance to Member States continued through 131 research contracts and agreements and 26 technical co-operation projects.

197. 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.

198. Co-ordinated research programmes also continued 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. Current research was reviewed and work plans for the future established at research co-ordination meetings on sheep and goat production, parasitic diseases of livestock and animal productivity in the Mediterranean and North African regions.

199. An advisory group meeting was held in Turkey on the use of nuclear techniques to assess and improve indigenous animal productivity in developing countries. A seminar on the use of nuclear techniques in animal reproduction, nutrition, disease and environmental adaptation studies was held in Turkey. A training course on the use of nuclear techniques for assessing and improving ruminant feeds was held at the Agricultural Laboratory, Seibersdorf.

200. Research in support of animal nutrition and reproduction programmes continued at Seibersdorf, leading to the development of a cheap, robust and reliable solid-phase radioimmunoassay kit for blood and milk progesterone determinations (available to Member States) and to the establishment of a fibrous residues data bank which receives the results of analyses of samples of animal feeds sent by Member States. Emphasis was placed on methodologies for the in vivo and in vitro assessment of rumen function using a rumen simulation apparatus.

Insect and pest control

201. Assistance to Member States continued through 28 research contracts and agreements and 21 technical co-operation projects.

202. The BICOT project[7] continued to make good progress. By the end of the year, almost 60% of the project area had been cleared of the target tsetse

[7] FAO/IAEA/Government of Nigeria Project for the Biological Control of Tsetse Flies by the Sterile-Insect Technique, the aim of which is to eradicate the tsetse fly from a 1500 km² area in Nigeria.

fly species (Glossina palpalis) through weekly releases of sterile males combined with intensive trapping and the use of insecticide-impregnated screens.

203. The major activities under the MISR-MED project[8] were an intensive Medfly survey, the development of computer programs for handling field data and the initiation of bait spray tests. The training of Egyptian project personnel continued.

204. Under the MOSCAMED project[9], the mass-rearing of flies at the La Molina laboratory proceeded satisfactorily, enabling monthly releases of sterile flies to be undertaken in the Tacna Valley. Radio communications and other equipment were installed at Moquegua in preparation for sterile-fly release operations in this valley.

205. Research and training activities continued at Seibersdorf in support of these three eradication projects.

206. Work continued under co-ordinated research programmes on genetic sexing of the Medfly and the development of methodologies for using the sterile-insect technique in tsetse fly eradication or control. Plans were made for initiating a programme on the standardization of Medfly trapping and one on the use of F-1 sterility in the control of lepidopteran pests and a field project to eradicate the tsetse fly (Glossina palidipes) in the Lambwe Valley, Kenya.

Agrochemicals and residues

207. Assistance to Member States continued through 70 research contracts and agreements and 14 technical co-operation projects.

208. As part of efforts to improve the safety and efficacy of agrochemicals, co-ordinated research programmes continued on pesticide residues in livestock products, stored grains and rice-fish ecosystems and on controlled-release pesticide formulations. The use of nuclear techniques permitted the determination of terminal residues in food and the extent of binding to food commodities and environmental substrates.

209. Radioisotope-aided research work continued at Seibersdorf in connection with two Italian-supported projects in Kenya - one on developing methods for the determination of trypanocidal drug residues in cattle and one on isolating microorganisms (obtained from African termites) containing enzymes capable of degrading lignocellulose.

210. At a research co-ordination meeting, participants reported on studies of lignocellulose-degrading microorganisms obtained by selection from mutant strains.

211. A co-ordinated research programme was initiated with the aim of determining and assessing the impact of agrofungicide residues in food plants.

[8] A project, jointly sponsored by the Agency and the Government of Egypt, for eradicating the Mediterranean fruit fly (Medfly) from the Nile Valley.

[9] A Medfly eradication project in Peru.

212. A regional training course on the use of nuclear techniques in pesticide research was held at the University of Costa Rica; it was attended by 25 participants from Central and South America.

213. A seminar on the use of radioisotopes in the development of controlled-release formulations of agrochemicals was held in Vienna; it was attended by 54 participants.

214. A consultants' meeting was held on the use of radiotracer techniques in assessing the biological activity and bioavailability of bound pesticide residues.

Food preservation

215. Assistance to Member States continued through 35 research contracts and agreements and 13 technical co-operation projects.

216. The number of countries participating in the work of the International Consultative Group on Food Irradiation increased to 23. The activities of the Group focused on trade promotion, training, feasibility studies and the public acceptance on food irradiation. Ways of reducing the impediments to international trade in irradiated food were considered and steps to promote the marketing of such food were recommended at a meeting convened in October.

217. Within the framework of the second phase of the Asian regional project on food irradiation (RPFI Phase II), a workshop on the commercialization of the ionizing energy treatment of food was held at Lucas Heights, Australia; it was attended by 18 participants from nine countries. Also at Lucas Heights, representatives of the Governments party to the agreement establishing RPFI Phase II agreed to harmonize legislation on food irradiation and to facilitate trade in irradiated food in the region covered by RCA.

218. FAO, the Agency and the Ministry of Agriculture and Fisheries of the Netherlands agreed to extend the agreement establishing the International Facility for Food Irradiation Technology (IFFIT), Wageningen, for two years starting on 1 January 1986.

219. A co-ordinated research programme on the use of irradiation as a quarantine treatment of food and agricultural commodities was initiated with the participation of ten institutions in seven Member States.

Medical applications

220. An international symposium on nuclear medicine and related medical applications of nuclear techniques in developing countries was held in Vienna, with the co-operation of WHO. Problems relating to the practice of nuclear medicine were reviewed from the point of view of the needs of developing countries.

221. Research co-ordination meetings were held to review progress made in optimizing nuclear medicine procedures for the diagnosis and treatment of thyroid disorders, the quality control of assays of thyroid-related hormones, the quality control of liver imaging procedures, the maintenance of nuclear instruments in Asia and the Pacific region and in Latin America, and the quality control of nuclear medicine equipment.

222. In the promotion of radioimmunoassay and related techniques, the emphasis continued to be on quality control and on the "train-the-trainers" approach to teaching these techniques in developing countries. An IAEA technical document entitled "Data processing in radioimmunoassay" was published. A "train-the-trainers" course was held in China, with 16 trainees from the South-East Asia region.

223. Workshops on the quality control of nuclear medicine instruments were held in Chile, Indonesia and Mexico. An IAEA technical document on the quality control of nuclear medicine instruments was published.

224. Technical advice and assistance were provided in connection with 72 technical co-operation projects covering 40 countries.

Dosimetry

225. Pursuant to a recommendation of the advisory group on the present status and future of the network of Secondary Standard Dosimetry Laboratories (SSDLs), the document "Criteria for the establishment of an SSDL" was revised and distributed to Member States; and a standard format for the annual reports of member SSDLs was devised.

226. A postal dose intercomparison involving 23 SSDLs showed good agreement of the dose values obtained by the SSDLs with the reference dose value given by the Agency's Dosimetry Laboratory.

227. A regional dosimetry calibration workshop was conducted at the Agency's Dosimetry Laboratory with the co-operation of the Hungarian Office of Measures.

228. About 120 radiotherapy departments, mainly in Latin America, the Far East and the Pacific region, participated in the cobalt-60 postal dose intercomparison service conducted by the Agency and WHO. Marked improvements in dosimetric accuracy were observed.

229. A study tour was organized to SSDLs in the Federal Republic of Germany, Sweden and the Soviet Union and to a primary standard dosimetry laboratory in Hungary.

230. A "Compendium of International Practice of Cobalt-60 Teletherapy" was issued as a joint publication of the Agency and WHO.

231. In July, an agreement concerning the provision of a dose assurance service by the Agency for irradiation facilities in Member States entered into effect through its acceptance by a Member State - Argentina; at the end of the year, it had been accepted by 13 Member States. As regards the technical operation of this dose assurance service, the Agency concluded an agreement with the Gesellschaft für Strahlen- und Umweltforschung (Federal Republic of Germany).

232. Normalization studies being conducted at a number of national standards laboratories with the aim of achieving standardized electron beam conditions for the co-ordinated electron dose assurance programme were completed.

233. The proceedings of an Agency symposium on high-dose dosimetry were published.

234. In 1985, support was provided for 40 technical co-operation projects relating to the establishment or further development of SSDLs.

235. In November, the arrangements for the establishment and operation of a network of SSDLs by the Agency and WHO which had existed since 1976 were formalized through the conclusion of an agreement between the two organizations.

Radiation biology

236. In Egypt, under the IAEA/WHO technical co-operation project on the use of brachytherapy in treating cancer of the cervix, a third training/demonstration course was attended by specialists from Kenya and Sudan as well as by Egyptian specialists.

237. The results of a co-ordinated research programme on the use of high-LET (linear energy transfer) radiation in non-conventional radiotherapy of cancer revealed the significant clinical advantages of this therapeutic technique for both advanced and developing countries.

238. An Agency seminar held in Kenya reviewed current nuclear techniques for the radiation sterilization of local medical supplies in developing countries of Africa and the Middle East.

239. Work continued on promoting relevant nuclear techniques for the radiation-sterilization of tissue grafts for clinical use in Asia and the Pacific region through an RCA co-ordinated research programme and an advisory mission to Sri Lanka.

240. The results of a co-ordinated research programme on radiation-induced chromosomal aberrations as a biological monitor in accidental over-exposure situations and of a co-ordinated research programme on the radiation treatment of sewage sludge for disinfection and safe reutilization were reviewed at research co-ordination meetings held in Japan.

241. Support continued for co-ordinated research programmes on the application of nuclear techniques in immunoprophylaxis and in the diagnosis of parasitic diseases; progress was reviewed during a symposium on nuclear medicine and related medical applications of nuclear techniques in developing countries. Progress in evaluating the use of monoclonal antibodies in radioimmunoassays as a means of achieving improvements in the diagnosis of

schistosomiasis, malaria and filariasis was reviewed at a research co-ordination meeting in Vienna.

Health-related environmental research

242. Initial results of a co-ordinated research programme on dietary intakes of nutritionally important trace elements were reviewed at a research co-ordination meeting held in Washington, United States of America. Support continued for a co-ordinated research programme on nuclear-related techniques in occupational health studies. The provision of quality control services in connection with these two programmes involved the publication of a directory of reference materials, an intercomparison of trace elements in total human diet and the supply of various reference materials to 301 institutes in 49 Member States.

243. Preparations were made for a co-ordinated research programme on applications of stable-isotope-labelled compounds in medical and nutrition research.

244. A report summarizing the results of two co-ordinated research programmes on the health-related monitoring of trace element pollutants using nuclear techniques was published, and the results of a follow-up co-ordinated research programme on the relationship between hair mineral concentrations and internal body burdens were reviewed at a research co-ordination meeting in the Federal Republic of Germany.

245. A co-ordinated research programme on toxic elements in foodstuffs was started for countries parties to RCA.

246. A new reference material intended for use in connection with the biological monitoring of cadmium (a toxic heavy metal) in the human kidney was certified (on the basis of the results of an intercomparison involving 74 participants in 35 Member States); it is now available under the Agency's analytical quality control services programme.

247. A training course on neutron activation analysis was held in India for participants from countries parties to RCA.

Nuclear physics

248. Assistance was provided in introducing nuclear science programmes into the curricula of universities in a number of developing Member States and two interregional training courses on nuclear physics techniques were organized. An IAEA technical document on selected topics in nuclear electronics was prepared.

249. 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) continued with the construction of further scintillation spectroscopy instruments of particular use to laboratories in developing countries.

250. A co-ordinated research programme on applications of solid-state nuclear track detectors using microcomputers was initiated and two interregional courses were organized.

Research reactor support programme

251. In the area of research reactor utilization, the Agency co-ordinated research on core management techniques, the aim being to improve radioisotope production in low- and medium-power research reactors, and on the development of software for small computers used in research reactor operation.

252. An interregional training course on the conversion of research reactors to low enrichment uranium (LEU) fuels was organized and guidebooks on LEU-fuel-converted reactors, solid-state physics and radioisotope production aspects of reactor utilization were prepared.

Fusion

253. The proceedings of the Tenth International Conference on Plasma Physics and Controlled Nuclear Fusion Research were published.

254. The INTOR Workshop, upon completing Phase 2A-Part 2 of its programme, prepared a report covering the work done on resolving certain issues that are critical to the feasibility of the INTOR concept; also, the physics and engineering data bases were evaluated.

255. 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.

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

Industrial applications and chemistry

257. As part of its efforts to promote the transfer of nuclear technologies employed in industry and chemistry, the Agency supported 116 technical co-operation projects in 44 countries.

258. Under a co-ordinated research programme on the immobilization of bioactive materials, success was achieved in immobilizing antibodies for diagnostic purposes.

259. A co-ordinated research programme on the radiation-induced modification of polymers for industrial and medical applications and one on the radiation-induced degradation of organic materials in nuclear environments were initiated.

260. Radiation technology for low-energy electron beam applications was reviewed by an advisory group which identified possibilities for the further development of this technology.

261. The recommendations of a group of consultants on the qualification and certification of non-destructive testing personnel proved useful in harmonizing the Agency's activities in Asia and the Pacific region and in Latin America.

262. Work started on the preparation of a guidebook on radioisotope tracer methods in industry (to be published in 1987).

263. A research co-ordination meeting on nuclear techniques in mineral exploration, mining and processing showed that a significant degree of co-operation had been achieved among the countries participating in the co-ordinated research programme.

264. The need for and availability of nuclear reference materials were reviewed by a group of consultants.

265. Advances in nuclear analytical techniques and the applicability of such techniques in developing countries were considered by a consultant group which concluded that there is a need to intensify the training of scientists from developing countries in the nuclear analytical field.

266. Other consultant groups considered questions of neutron sources for neutron activation analysis, with emphasis on the applications of neutron activation technology, and the cyclotron production of radionuclides using enriched targets.

267. Further 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.

Isotope hydrology

268. During 1985 the Agency supported 41 technical co-operation projects in 34 countries; 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, water pollution, geothermal studies and sediment dynamics. Also, assistance was provided in connection with two hydrological studies being conducted within the framework of UNDP projects.

269. Assistance was provided to various Member States in establishing and/or upgrading facilities for environmental isotope analyses and in interpreting isotope analysis data relating to specific hydrological problems.

270. Through 41 research contracts, 9 research agreements and 1 technical contract together involving 28 countries, the Agency continued to promote the development of new and the improvement of existing methodologies.

271. Four co-ordinated research programmes on isotope hydrology continued - one in the Far East (financed by Australia), two in Latin America (one financed by the Federal Republic of Germany and one by Italy) and one covering eight countries in different parts of the world. These programmes include the award of research contracts to or the conclusion of research agreements with the participating countries, visits by experts and the provision of analytical services by laboratories in the financing countries and by the Agency's laboratories. The first co-ordination meeting under the co-ordinated research programme financed by the Federal Republic of Germany, on the use of isotope techniques in hydrology in Latin America, took place in Piracicaba, Brazil.

272. A regional seminar on the use of isotope techniques in arid and semi-arid lands held in Adana, Turkey, was attended by 64 participants from 18 Middle East and North African countries.

273. An advisory group made recommendations aimed at promoting the use of sulphur isotopes in hydrology and in the earth sciences.

274. A consultant group considered questions regarding stable isotope reference samples for geochemical and hydrological investigations.

Nuclear data

275. 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. During 1985 the Agency received more than 700 requests from 45 Member States for experimental and evaluated data, data processing computer codes and publications. The Agency continued to publish the quarterly Bulletin on Atomic and Molecular Data for Fusion and the Computer Index of Neutron Data (CINDA).

276. 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 and assess the requirements for nuclear data in the field of radiotherapy and radiobiology and to assess the requirements for atomic data in fusion plasma modelling and for data in the calculation of radiation damage to nuclear reactor structural materials.

277. In order to stimulate the production of necessary nuclear and atomic data and to improve the accuracy of existing data, the Agency convened a research co-ordination meeting on the measurement and analysis of 14-MeV neutron data required in fission and fusion reactor technology and one on the nuclear properties of heavy radionuclides.

278. An interregional training course on basic and applied nuclear physics was held within the framework of efforts to promote the transfer of nuclear data technology to developing Member States. The Agency 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, three fellows from developing countries received training in the techniques of nuclear data compilation and computer processing.

Seibersdorf Laboratory

I. Agricultural biotechnology; the joint FAO/IAEA programme

Soil fertility, irrigation and crop production

279. Fertilizer and water use studies were conducted for annual crops, pastures and orchards. The availability of nutrients from natural sources (rock phosphate, guano) and through nitrogen fixation in leguminous plants and in Azolla (the fern used in rice paddies) was investigated in field and greenhouse experiments utilizing isotopic techniques. Services to co-ordinated research programmes and technical co-operation projects continued through analytical assays of about 12 000 samples for nitrogen-15 determination; facilities for increased analytical throughputs were established.

280. Thirty-six scientists received training through two interregional training courses, and eight trainees and two scientific visitors received a total of 48 man-months of training in nuclear techniques for use in soil-plant relationship research.

Plant breeding and genetics

281. Studies on in vitro mutagenesis - including the screening of regenerated pea, maize, cassava and banana plants - were carried out, and mutagenesis was achieved in Azolla. In vitro morphogenesis and somatic embryogenesis were studied in yam and cacao. About 400 seed irradiation treatments were carried out as a service to plant breeding institutes in Member States. Three video films are produced for training and 20 scientists participated in a training course on mutation breeding. Nine trainees and scientific visitors received a total of 17 man-months of training.

Animal production and health

282. A radioimmunoassay laboratory for animal reproduction studies was established as a complement to the existing animal nutrition facility. A training course was held on the use of isotope-aided techniques in ruminant nutrition studies. Two trainees received training in animal nutrition and two in the use of radioimmunoassay techniques. Radioimmunoassay kits for determining progesterone in animal milk and blood were developed and supplied to technical co-operation counterparts. Determinations were made of the nutritive value of fibrous residues received from developing Member States.

Insect and pest control

283. More efficient and effective methods of rearing and transporting tsetse flies were developed for use in the eradication project in Nigeria (BICOT). A back-up colony of 70 000 breeding females was established and 140 000 excess pupae were shipped to Nigeria for the BICOT project. Artificial diets were developed for rearing tsetse flies. Work continued on developing genetic techniques for eliminating females from the mass-rearing process for the Mediterranean fruit fly (Medfly) so that only male flies are released after sterilization. Experiments were carried out with a view to developing new

mass-rearing systems for Medflies; they included work on formulating diets for larva rearing that contain only domestic ingredients from Egypt. Forty man-months of training in the use of entomological techniques were given to 13 trainees.

Agrochemicals and residues

284. Pesticide formulation experiments continued, and new formulations were applied in rice paddies in Indonesia and Hungary. New, more sensitive analytical methods were developed for determining three important trypanocidal drugs in bovine serum. Further experiments relating to biomass degradation were carried out. Three trainees received a total of 15 man-months of training in the use of radioisotopes and in general analytical work.

II. Life sciences

Environment and nutrition

285. Work continued on the applications of nuclear analytical techniques in studies of trace elements in human diets, hair, coffee and the human kidney and liver. Support was given to three co-ordinated research programmes with altogether 40 participants. The analytical capabilities of the Laboratory were further extended through the development of two radiochemical procedures for the simultaneous determination of mercury, selenium, copper, manganese, cadmium, molybdenum and chromium in biological materials by neutron activation analysis coupled with inorganic ion-exchange and volatilization treatment.

286. About 5000 determinations were made of various trace elements in some 1500 different materials using neutron activation-gamma ray spectrometric analysis. Under the Agency's analytical quality control services programme, homogeneity tests were carried out on four materials to be used in determining trace element contaminants and measuring environmental radioactivity. Five trainees received altogether 25 man-months of training in the use of various analytical methods.

Radiation dosimetry

287. 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. Four batches of thermoluminescence dosimeters were evaluated for a total of 120 hospitals and 23 SSDLs. A pilot study involving eight institutes was performed using solid thermoluminescence dosimeters and a semi-automatic read-out system. An interregional workshop on the calibration of secondary standard dosimeters was held at the Laboratory. A neutron irradiator and a panoramic gamma irradiator were installed, tested and modified; they are being used in the calibration of radiation protection instruments. Two trainees spent a total of seven man-months at the Dosimetry Laboratory at Seibersdorf.

III. Physical sciences

Chemistry and analytical quality control

288. Twelve intercomparisons of radionuclide and trace element analyses were completed; laboratories in about 30 countries took part in one or more of these intercomparisons. Nine reference materials were added to the list of

such materials available from the Agency; the list now contains 49 items. The laboratory supplied 1060 aliquots of such materials to 350 institutes in Member States at a price of \$50 000; the book value of samples held in stock is now \$1 600 000.

289. Co-operation continued with the World Meteorological Organization (WMO) on the analysis of air samples from WMO's Background Air Pollution Monitoring Network. Some 160 samples of rain water and over 300 air filters were received, and more than 2000 individual analytical data were reported. An atomic-emission spectrometer of advanced design was installed and calibrated for use in simultaneous multi-element determinations.

Hydrology

290. Approximately 1300 water samples were analysed for oxygen-18, 1400 for deuterium, 1000 for tritium, 140 for carbon-14 and 170 for carbon-13 in support of technical co-operation projects and in order to obtain data for the global precipitation monitoring network. Chemical analyses were performed on 205 water samples (1200 individual element determinations) for WMO and on 100 water samples (1200 individual element determinations) in support of technical co-operation projects.

Soil water research

291. A co-ordinated research project for the comparison of nuclear and non-nuclear methods in soil water studies was initiated. Field and laboratory experiments were carried out for the purpose of studying the performance of neutron moisture and gamma density probes. An expert mission visited Ecuador in connection with a technical co-operation project of nuclear methods in water balance studies.

Instrumentation

292. A prototype of the modular gamma spectrometer which the Laboratory is developing in order to make it available to Member States in kit form was checked and necessary modifications made to the operating manual; 420 kits are being prepared for distribution to users in developing Member States. A new design was developed for a sample changer to be used in automated urine analysis for contamination monitoring. In the electronics training laboratory, now equipped with three personal computers, six trainees received training for a total period of 29 man-months.

IV. Safeguards analytical laboratory (SAL)

293. SAL received over 800 samples of uranium, 230 samples of plutonium or mixtures of uranium and plutonium, and 300 samples of spent fuel solutions, a 25% increase over the total number of samples received in 1984. In addition, 35 samples of plutonium nitrate were certified for the calibration of K-edge densitometers and eight uranium dioxide pellets were analysed for the characterization of non-destructive assay working standards.

294. About 220 samples of spent fuel solutions were sent for analysis at laboratories belonging to the Agency's back-up network following a 140% increase in the number of such samples received at SAL.

295. Delays in the analysis of plutonium and spent fuel samples were reduced by 30-50%.

296. A method for the internal calibration of isotope dilution mass spectrometry analyses was tested with the co-operation of Oak Ridge National Laboratory, United States of America, and laboratories at La Hague and Saclay, France.

International Laboratory of Marine Radioactivity

297. Following the recommendations of a group of consultants which reviewed the scientific activities of the Laboratory in 1984, the Laboratory continued to concentrate on research related closely to radiation protection aspects of waste management in the marine environment. They included the provision of technical support for marine radioactivity monitoring and investigations, the collection of data for evaluating radiological impacts of radionuclide releases into the marine environment and - with the help of external funding - participation in international marine pollution monitoring and research efforts.

298. Improvements in radiochemical procedures for measuring long-lived radionuclides such as technetium-99 and neptunium-237 in large volume seawater samples were achieved and a method for actinium-228 determination was developed.

299. Reference samples of seawater, seaweed, sediments and other materials of marine origin were distributed to national laboratories for radionuclide measurement quality control purposes; intercalibration exercises involving radionuclide measurements were organized with the participation of approximately 30 institutions in 30 countries.

300. In order to obtain data necessary for evaluating radiological impacts of radionuclide releases into the marine environment, experimental and field studies were continued with the co-operation of institutions in a number of countries, including Denmark, France, the Federal Republic of Germany, Sweden, the United Kingdom and the United States.

301. Vertical fluxes of radionuclides associated with particulate matter in the sea were studied by deploying sediment traps at various depths in the Pacific and the Mediterranean and by analysing trapped materials for radionuclides. Comparisons were made of the behaviour of technetium-99, caesium-137 and transuranic nuclides in different marine regions such as the Mediterranean, the North Sea and the Arctic Ocean around Greenland. Studies on the speciation and behaviour of nickel and cobalt in interstitial water were initiated in order to obtain information on the mobility of these elements within marine sediments and at the sea-bed/bottom water interface.

302. On the recommendation of an expert group, the Laboratory started compiling and evaluating radionuclide inputs into the marine environment, the aim being to estimate radionuclide input and output fluxes so as to ascertain whether the inventories are consistent with the estimated fluxes.

303. The Laboratory supported UNEP's Ocean and Coastal Area Programme by providing scientific and technical assistance in the development of guidelines and reference methods for pollutant measurement, in the measurement of heavy metals and hydrocarbons in samples collected from the coastal zones of some Member States and in the organization of pollutant measurement intercalibration exercises, by training scientific personnel in pollutant measurement and by helping to ensure the proper functioning of measuring instruments supplied to participating countries. These activities covered the Mediterranean, the Kuwait region and West and Central Africa.

Main fields of research and training-for-research

304. The main fields of research and training-for-research at the Centre in 1985 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 environment and of natural resources (physics of the atmosphere, geophysics);
- (e) Physics and development;
- (f) Mathematics (applicable mathematics);
- (g) Physics teaching; and
- (h) Training at Italian laboratories.

Physics and energy

305. The Italian National Institute of Nuclear Physics sponsored a second workshop on perspectives in nuclear physics at intermediate energies and also a related course on nuclear and particle physics at intermediate energies with hadrons. The former was attended by 99 scientists, 20 of them from developing countries, and the latter by 50 scientists, all from industrialized countries.

306. There followed a spring college on plasma physics entitled "Charged Particle Transport in Plasmas", which was attended by 134 scientists, 86 of them from developing countries. During the spring college, a prize in honour of Professor M. Sandoval Vallarta was awarded to Dr. Ricardo Galvao, from Brazil, for his outstanding contribution to plasma physics.

307. In September, a workshop on the physics of non-conventional energy sources and material science for energy attracted 178 scientists, 144 of them from developing countries.

308. Lastly, in October a topical meeting was held on the phase space approach to nuclear dynamics.

Fundamental physics

309. The main activity was a summer workshop on high-energy physics and cosmology attended by 144 researchers, 100 of whom were from developing countries.

310. A conference on tests of electroweak theories, polarized processes and other phenomena was organized by the Centre in collaboration with the

Department of Theoretical Physics of the University of Trieste, the Italian Institute for Nuclear Physics and the International School for Advanced Studies, Trieste. Forty-six scientists attended, two of them from developing countries.

311. One hundred and fifty scientists contributed during the year to elementary particle research at the Centre.

312. In view of the late Professor Paul Dirac's special association with the Centre, the award of two medals bearing his name was announced on his birthday (8 August). Professor Yakov Zeldovich of the Space Research Institute, Moscow, was honoured for far-ranging contributions to relativistic astrophysics, particularly in theories of compact objects and of cosmic evolution, and Professor Edward Witten of Princeton University was honoured for stimulating contributions to quantum field theory, particularly with regard to the implications of new kinds of anomalies.

Physics and technology

313. The 1985 programme opened with a college on lasers and atomic and molecular physics which was divided into three parts - an introductory week, a topical meeting on free-electron lasers and a topical meeting on multiphoton processes. One hundred and sixty-two scientists, 79 of whom from developing countries, attended the college throughout.

314. A workshop on the quality control of X-ray equipment was attended by 36 scientists, 7 of them from developing countries.

315. A research workshop on condensed matter was held throughout the summer and was followed by a symposium on fractals in physics. Two hundred and forty-three scientists (181 from developing countries) took part in the workshop and 125 (13 from developing countries) in the symposium.

316. In August there was a meeting of a working party on the mechanical properties and behaviour of solids and a symposium on hopping transport. They attracted 33 and 63 researchers respectively, about a fifth of them from developing countries.

317. Following previous successful sessions, a further college on microprocessors was held, with particular emphasis on their applications in physics. Also, a college on the same subject was organized in Bogotá, Colombia.

318. A small microprocessor training and demonstration laboratory, operated in conjunction with the Italian National Institute of Nuclear Physics and financed by the Italian Department for Development Co-operation through the United Nations University, was established in October.

319. Some 50 scientists were associated during the year with the work of the permanent research group in condensed-matter physics.

Physics of the environment and of natural resources

320. A college on soil physics was held with the aim of providing participants with a fundamental understanding of soil physical properties and processes; within the framework of the college, a colloquium on energy flux at the soil atmosphere interface was held. There were over 100 participants, 80% of them from developing countries.

321. The Centre organized a workshop on sand transportation and desertification in arid lands which was held in Khartoum, Sudan.

322. The academic year ended with an autumn workshop on cloud physics and climate and a workshop on drought, desertification and food deficit organized by the Third World Academy of Sciences.

Physics and development

323. A conference on south-south and south-north co-operation in science, organized by the Third World Academy of Sciences, was opened by the Secretary-General of the United Nations and attended by nearly 200 scientists, mainly from developing countries.

324. As in the past, throughout the year invited experts and participants in the various scheduled activities delivered lectures relevant to the "Physics and development" programme.

Mathematics

325. The number of researchers increased from 15 to 29, only 2 of them from industrialized countries.

326. A workshop on mathematics in industry dealt with the application of mathematics to real problems (mathematical modelling) and included both lectures and practical exercises (simulation). Of the 85 participants, two thirds were from developing countries.

327. As a follow-up to a course held in the autumn of the 1984, a workshop on semi-groups and their applications was organized for a small number of invited scientists.

328. Two interrelated courses - a college on representation theory of Lie groups and a workshop on graded differential geometry - concluded the programme of mathematics research in 1985.

Physics teaching

329. A summer school on physics teaching at university level was organized for French-speaking African researchers (32); the 10 lecturers came from Belgium and France.

Training at Italian laboratories

330. Under a programme started in 1982, the Centre awarded 100 grants to scientists from developing countries for training at Italian academies and industrial laboratories.

Activities outside the scheduled programme

331. Over 100 scientists 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.

332. In addition to the courses on the scheduled programme, the Centre sponsored or co-sponsored 39 courses held outside Trieste.

Safeguards statement for 1985

333. In 1985, 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[10]. It is considered reasonable to conclude that nuclear material under Agency safeguards in 1985 remained in peaceful nuclear activities or was otherwise adequately accounted for. This statement should be seen in the light of the following observations:

- (a) Extensive safeguards activities in 1985 resulted in more than 1980 (1820 in 1984) inspections carried out at 514 (474) nuclear installations in 51 (49) non-nuclear-weapon States and four (three) nuclear-weapon States. In 32% (30%) of inspections nuclear material was verified by non-destructive assay (NDA). More than 290 (240) automatic photo and television surveillance systems operated in the field, and 9000 (8300) seals applied to nuclear material were detached and subsequently verified at Headquarters. More than 1270 (1080) plutonium and uranium samples were analysed, with about 3250 (2770) analytical results being reported. Accounting and other safeguards data comprising 561 000 (760 000) 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 150 (400), mostly minor, discrepancies or anomalies were found. All cases 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, the performance of the Department of Safeguards and, for a particular installation or State, on the content of the safeguards agreement including subsidiary arrangements, concluded with the State in question, and on the co-operation of the State and of the facility operators in it;
- (d) The safeguards findings refer for each facility to the latest available State report, Agency inspection, analysis, etc. relating to that facility.

Safeguards coverage

334. By the end of 1985 there was a total of 163 safeguards agreements in force with 96 States, compared with 163 agreements in force with 95 States at the end of 1984.

[10] 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.

335. On 10 June 1985, the safeguards agreement relating to the voluntary offer by the Soviet Union to place some of its peaceful nuclear installations under Agency safeguards entered into force. During 1985, safeguards were applied in four nuclear-weapon States pursuant either to voluntary-offer agreements or to safeguards transfer agreements - namely, France, the Soviet Union, the United Kingdom and the United States of America. In September 1985, in the Agency's General Conference, the delegate of China announced that the Chinese Government had decided to place voluntarily some of its civilian nuclear installations under Agency safeguards at an appropriate time.

336. Six non-nuclear-weapon States became party to NPT during 1985 (Brunei Darussalam and the Seychelles in March, Kiribati in April, Bhutan in May, Belize in August and the Democratic People's Republic of Korea in December), bringing the total number of States party to the Treaty to 130, including three nuclear-weapon States.

337. As of 31 December 1985, of the 127 non-nuclear-weapon States party to NPT 39 had not complied, within the prescribed time limit, 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 States has, as far as the Agency is aware, significant nuclear activities.[11]

338. Safeguards were actually applied in 41 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.

339. During 1985 an amendment to an existing safeguards agreement with Spain entered into force, enabling Spain to place under Agency safeguards any new peaceful nuclear facilities it may acquire. Safeguards agreements based on INFCIRC/66/Rev.2 were in force with the following nine non-nuclear-weapon States not party to either NPT or the Tlatelolco Treaty: Argentina, Brazil, Chile, Cuba, India, Israel, Pakistan, South Africa and Spain.[12] Safeguards were actually applied in eight of the nine States pursuant to these agreements. Also, safeguards were applied pursuant to INFCIRC/66/Rev.2-type agreements in Viet Nam and the Democratic People's Republic of Korea, both party to NPT.[13]

340. In five of the nine States referred to in the second sentence of paragraph 314 above, as in nuclear-weapon States, unsafeguarded facilities of significance for safeguards were known to be in operation or under construction.

[11] Draft safeguards agreements with Tuvalu and Belize were approved by the Board of Governors in February 1986.

[12] See also paras 40-44, which refer to resolutions concerning the application of safeguards in Israel and South Africa adopted by the Agency's General Conference in September 1985 and by the General Assembly of the United Nations at its 40th session.

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

341. On 31 December 1985, there were 474 nuclear facilities under safeguards or containing safeguarded nuclear material (460 in 1984); there were also 413 locations outside facilities containing small amounts of safeguarded material (415 in 1984) and two non-nuclear installations (one in 1984) 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 (ten also in 1984).

342. At the end of 1985, the nuclear material under Agency safeguards, including that covered by voluntary-offer agreements with nuclear-weapon States, amounted to 9.0 t (7.7 t in 1984) of separated plutonium, 155.1 t (129.5 t) of plutonium contained in irradiated fuel, 12.3 t (11.8 t) of high-enriched uranium (HEU), 24 546 t (22 784 t) of low-enriched uranium (LEU) and 43 044 t (31 724 t) of source material (see paragraph 343). The greater part of this material was in non-nuclear-weapon States where safeguards are applied to all peaceful nuclear activities. Non-nuclear material under Agency safeguards included 1432 t (1362 t) of heavy water.

343. The following tabulation illustrates the growth of safeguards during the last decade:

	<u>1975</u>	<u>1980</u>	<u>1985</u>
- States with safeguards agreements in force:	64	86	96
- Number of facilities under safeguards or containing safeguarded material:	315	416	486
- Approximate quantities of nuclear material subject to Agency safeguards:			
- Separated plutonium	2 t	6 t	9 t
- Plutonium contained in irradiated fuel	15 t	79 t	155 t
- High-enriched uranium	4 t	11 t	12 t
- Low-enriched uranium	3 091 t	13 872 t	24 546 t
- Source material, including depleted uranium and thorium	4 440 t	19 125 t	43 044 t
- Expenditure (in \$1000) incurred by the Department of Safeguards (adjusted to 1985 rates of exchange and 1985 price levels)	7 230	17 182	29 931
- Professional staff at year end	69	160	248
- General Service staff at year end	40	106	166
- Number of facilities:			
- With a significant amount of nuclear material	70	194	297
- With inspection goal attained	23	91	168

Major activities during 1985

Safeguards implementation

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

- A total of 1981 inspections (compared to 1820 in 1984) were performed, representing 7750 man-days of inspection (compared to 6599 in 1984);
- Inspection effort deployed in 1985 achieved a coverage of 72.9% (71.3% in 1984) with regard to the total planned actual routine inspection effort;
- The number of inspections where NDA measurements were performed was 637, against 546 in 1984;
- The number of major facilities at which inspection goals were attained for the whole facility was 10% higher in 1985 than in 1984;
- The timeliness of inspection reporting improved further in 1985, with the result that the average period between an inspection and the dispatch of the results to the State was reduced to 111 days (from 171 days in 1984);
- The computerized evaluation of data in inspection reports, previously used for reactors only, was extended to a number of facilities of other types;
- The first safeguards inspection in the Soviet Union took place in August after the conclusion of negotiations on the Subsidiary Arrangements including facility attachments;
- By the end of 1985, facility attachments for three centrifuge enrichment plants had entered into force and the first unannounced inspections had been carried out at two of these three plants;
- Discussions on the application of safeguards to a semicommercial enrichment plant in South Africa continued and, after a visit to the plant in August, Agency officials prepared a draft of a safeguards approach for the plant and transmitted it to South Africa;
- Discussions continued with Argentina concerning safeguards equipment to be installed at a heavy-water production plant subject to safeguards, which is expected to begin operations in the near future;
- Additional efforts were made to speed up the negotiation and finalization of several outstanding facility attachments, with the result that 27 new facility attachments entered into force during the year. In addition, 32 existing facility attachments were renegotiated and entered into force;

- In one State, a simultaneous physical inventory verification at all major facilities involved in the natural uranium fuel cycle was carried out for the third consecutive year. In several other States, simultaneous inspections at facilities handling the same category of nuclear material and identical items were carried out;
- The IAEA Offices in Tokyo and Toronto continued to make a significant contribution to effective and efficient safeguards implementation; consultations started on the question of transforming one of the Offices into a Regional Office.

345. As a result of an anomaly, detected in the course of 1984, regarding an export of depleted uranium made without due notification to the Agency, improved procedures were introduced within the Agency to improve follow-up action in the event of anomalies, and discussions were held with representatives of certain States to improve co-ordination on such matters in the future.

Safeguards information treatment

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

- Some 21 000 State reports were processed. The data base increased by 15%, to approximately 4.3 million records;
- Recommendations, made by consultants in 1984, to the effect that more information concerning unconfirmed international transfers of nuclear material should be provided to all States concerned were implemented. For reports on international transfers received in 1985, the Agency was able to match 79% of the notifications of shipments with notifications of receipt within the year of reporting (68% in 1984). The average time taken to match notifications of receipt with notifications of shipment by machine identification was reduced from six to four days, while the time for matching manually was reduced from 12 to 9 days;
- Recommendations made by consultants for the establishment of a de minimis limit below which shipper/receiver differences may be regarded as negligible were implemented, a total of 0.1 SQ in any given 12 months being taken as the limit;
- Bilateral technical consultations were established with a group of States on the question of unconfirmed transfers, and preparations were made for the establishment of similar consultations with two other States;
- A joint standing working group on accounting and reporting was established by the Agency and a State with significant nuclear activities;
- Discussions continued with two States on the submitting of reports pursuant to INFCIRC/66/Rev.2 type agreements on magnetic tape, its feasibility depending on the acceptance of a standardized reporting system by States;
- An on-line transaction processing system for inspection report data entry and correction was introduced at the beginning of the year;

- A system for recording information on seals using a personal computer was established for the IAEA Office in Tokyo;
- Criteria were defined and procedures implemented for the quality control of data relating to the use of seals;
- A system was designed for the computer-assisted production, on a trial basis, of inspection statements made pursuant to sub-paragraphs 90(a) and (b) of INFCIRC/153 (Corrected) using information from the inspection data base;
- Revision of the computerized safeguards equipment inventory system continued, the aim being to facilitate the monitoring of equipment utilization and maintenance.

347. The computer configuration used in support of the IAEA Safeguards Information System (ISIS) was upgraded through replacement of the mainframe computer and the acquisition of a new data storage facility.

Safeguards_development_and_technical_support

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

- the performance monitoring and control programme for safeguards equipment was further expanded, with the emphasis on ensuring the long-term reliability of safeguards equipment and on the efficacy of the procedures for implementation;
- the Agency participated in a demonstration, carried out by a Member State, of the feasibility of enrichment monitoring systems for use in cascade areas of centrifuge enrichment plants;
- a plutonium calorimeter was successfully tested under field conditions and one with a greater operational range was ordered;
- the design of a gamma ray and neutron measuring device for spent fuel verification was finalized and the data analysis procedure improved;
- the STAR television surveillance system underwent extensive testing to determine its reliability (see also para. 333 below);
- the first phase of a multiplexed television surveillance system capable of serving up to eight cameras was developed and testing was initiated;
- development work started on a new, compact television surveillance system;
- a feasibility study was successfully conducted on a tamper-resistant transmission link for television surveillance pictures;
- the laser-based surveillance system for spent fuel was further developed in preparation for field testing;
- vulnerability testing on an ultrasonic sealing system for irradiated CANDU fuel stores was completed;

- substantial work was done on preparing a new portable multichannel analyser for routine use;
- installed measurement and surveillance systems at two facilities were positively evaluated for effectiveness.

349. In the designing of specific safeguards approaches, 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 uranium enrichment plants:

- A demonstration of near-real-time material accountancy at one reprocessing plant was initiated and preparations for a similar demonstration at another plant continued;
- The development of safeguards approaches for a pilot nozzle-enrichment facility was initiated;
- The development of safeguards approaches for large-scale automated MOX fuel fabrication plants was initiated and the modification of safeguards procedures for specific MOX fuel fabrication plants was completed.

350. Practical safeguards implementation requirements stimulated the development of improved safeguards approaches for other nuclear fuel cycle facilities. In particular:

- the development of a safeguards approach for a heavy-water production plant was completed and a special project established for its implementation;
- work continued on improving safeguards implementation at specific on-load refuelled reactors;
- recommendations were made for modifying the safeguards procedures at some LWRs where surveillance results are difficult to interpret;
- development work continued on safeguards approaches for spent fuel storage facilities both at away-from-reactor locations and at reprocessing plants.

351. An analysis of safeguards approaches used by the Agency at MOX fuel fabrication plants and the problems encountered in the course of their implementation was performed for use by the Standing Advisory Group on Safeguards Implementation (SAGSI) in studies on safeguards approaches.

352. The development of detailed guidelines for establishing and maintaining a State System of Accounting for and Control of nuclear material (SSAC) at the facility level was completed for LWR-type power reactors, for on-load refuelled power reactors, for MOX fuel fabrication plants and for research facilities, and a detailed description was formulated of an SSAC at the State level.

353. In the field of technical services,

- about 340 photo cameras were repaired, tested and delivered to the Operations Divisions for field use;

- about 1850 photo surveillance films were developed and reviewed for equipment performance (this represented a 20% increase, which was accommodated thanks to new dark room facilities permitting both black/white and colour film processing);
- the number of seals received for verification was more than 9000 (this represented a 9% increase);
- to handle the growing seal verification workload, a system based on the storage of the video images of seals on a laser disk was commissioned;
- the number of shipments of safeguards equipment and supplies to the field was over 220 (this represented an increase of about 15%, there being a commensurate increase in the amount of equipment and supplies which inspectors transported by hand).

354. The number of twin-camera photo surveillance units installed in facilities increased further, to about 250 (225 at the end of 1984). The incidence of photo surveillance failure caused by equipment deficiencies was halved. This reflects improvements in the cameras and efforts to identify and replace faulty cameras at an early date.

355. Work continued on establishing a computerized data base for equipment inventory control, the scheduling of routine maintenance and the determination of equipment reliability.

356. The trend towards the in-field repair and maintenance of NDA equipment, with the aim of improving equipment availability, continued.

357. Deployment of the STAR video surveillance system was delayed by a variety of problems related mainly to video recorders. The introduction of portable multichannel analysers (PMCA) was impeded by problems with detectors and high-voltage stabilization circuitry. However, there was significant progress in the deployment of advanced photo surveillance units.

358. A working group continued a comprehensive assessment of short-term and long-term equipment requirements, with the aim of producing an updated projection early in 1986.

Safeguards_evaluation

359. 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. Altogether 2342 inspection reports (2224 in 1984) and 2482 inspection statements (2461 in 1984) were reviewed using computer-assisted review procedures.

360. Internal reviews were made of safeguards applied in two randomly selected States and follow-up assessments were made of the implementation of actions recommended as a result of two previous internal reviews.

361. Work started on establishing a comprehensive quality assurance programme for the Department of Safeguards. The main components of such a programme were identified and arrangements were made for the participation of staff from each Division in its elaboration during 1986.

362. Arrangements were completed for evaluating all facility data for the SIR with the help of computer-assisted procedures, almost all the data being taken directly from computerized inspection reports for the majority of inspections. An action plan for solving problems identified in the SIR for 1984 was approved and progress in its implementation was regularly monitored by management.

363. Work continued on redesigning the format and content of inspection statements made pursuant to sub-paragraphs 90(a) and (b) of INFCIRC/153 (Corrected) so as to permit more efficient (computer-assisted) production of the approximately 2500 statements which the Agency has to send out each year. Work also continued on elaborating the technical criteria for assessing inspection goal attainment which will be necessary given the technological developments expected during the next ten years.

364. 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 the accuracy of tank calibrations at bulk-handling facilities, with the preparation and characterization of NDA reference materials and with the preparation of statistical sampling plans;
- data evaluation services were provided to the Division of Development and Technical Support in connection with the analysis of test data for three K-edge densitometer instruments, with the implementation of procedures for the automatic transfer of data from NDA instruments to computers and of related software for rapid data reduction and analysis, with the design of an NDA measurement and calibration data bank, and with statistical analyses of the reliability of seals and cameras;
- new computer files were established for tracking the shipment and analysis of analytical samples, for storing and retrieving operator and/or Agency measurement data, and for storing and retrieving estimates of operator and/or Agency measurement errors;
- evaluation procedures and criteria were reviewed and instructions written for use in the preparation of inspection reports, inspection statements, the IAEA Safeguards Glossary, training courses and the Safeguards Technical Manual.

Standardization, training and administrative support

365. Advice continued to be provided in a variety of areas, especially financial management, manpower recruitment and allocation, and overall management.

366. 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, the projection of manpower needs, and the recording of inspector designation problems. Overall management included generic issues such as organizational structure and the formulation of terms

of reference for internal co-ordination groups and specific issues such as the interrelationship of managerial responsibilities. Support was provided in the processing of documentation for inspection travel and other duty travel, the level of which continued to increase.

367. A review of basic technical documents, including model facility attachments for different types of nuclear facilities and of model safeguards approaches, continued with the aim of standardization.

368. A standardized format for computerized data entry to be used in reporting on inspections carried out at all types of facilities under safeguards was introduced in January 1985. During the year work continued on refining the computerized inspection reporting system.

369. A new Safeguards Manual, containing a comprehensive set of instructions and guidelines, was introduced with effect from January 1985. During the annual review of the Manual, a number of amendments were made in the light of the experience gained during the first year of its utilization.

370. Two introductory courses on Agency safeguards for new inspectors were conducted; they included NDA courses and comprehensive inspection exercises performed in the German Democratic Republic, the Soviet Union and the United States. Nine advanced courses for Professional staff were conducted at Headquarters and in six Member States (France, Italy, Sweden, the Soviet Union, the United Kingdom and the United States). Four refresher courses were held for Professional staff of the Department of Safeguards and for EURATOM safeguards personnel. Three courses were designed for broader participation.

371. For the ten safeguards trainees participating in the second training programme for junior professionals from developing countries, the programme consisted of classroom lectures and visits to operating nuclear facilities in the Federal Republic of Germany and additional training at Headquarters. The group attended a comprehensive inspection exercise in the German Democratic Republic and individual trainees accompanied inspectors in the field. Three of the trainees have been offered positions in the Department of Safeguards and two of these have accepted. A third programme, which includes ten safeguards trainees, began in January 1986.

Support by outside expert groups and by Member States

372. SAGSI held two series of meetings within the framework of a long term plan for obtaining SAGSI's advice on safeguards approaches for various types of nuclear facilities. SAGSI members held part of the first of their 1985 series of meetings in the Federal Republic of Germany in order to see a demonstration of safeguards activities at a MOX fuel fabrication plant. Problems arising out of implementing safeguards at this type of facility were considered during the second series of meetings.

373. In addition, SAGSI made recommendations concerning the safeguards R & D programme and related meetings proposed for 1987 and 1988 and recommendations concerning a problem area highlighted by a past SIR: the problems arising from incomplete inventory verification.

374. A number of other advisory group and similar meetings took place in 1985:

- An advisory group on neutron coincidence counting techniques agreed that the present development activities should continue,

with a view to improving the performance of present methods by stimulating interest in fundamental problems of neutron coincidence counting techniques, and that the systems currently being developed would not be available for inspection use for several years;

- A technical meeting on closed-circuit television (CCTV) for safeguards surveillance purposes provided an opportunity to explore ways of solving surveillance problems on the basis of commercially available equipment;
- A group of consultants on the development of Cherenkov viewing devices and their use in the verification of spent fuel concluded that, although the experimental data available do not cover all situations, the Cherenkov viewing technique is very useful as it entails minimum intrusion into facility operations and the viewing devices are small and light;
- Experts from the Network of Analytical Laboratories (NWAL) reviewed the services required in the analysis of spent fuel samples, reaching agreement on sample treatment procedures and measurements, on shipment procedures to ensure timely service, and on the timeliness and method of reporting results;
- Consultants considered practical problems encountered in preparing samples of plutonium products and spent fuel solutions and made recommendations with regard to sampling, to sample treatment, transport and analysis procedures and to R & D work. These recommendations are being taken into account in efforts to further improve the destructive analysis techniques used for verification purposes;
- Consultants considered statistical procedures for evaluating the quality of safeguards analytical measurements and recommended modifications of some features of the current data analysis methodology.

3/5. Substantial contributions to the safeguards development programme were again made through 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 and the European Community provided support, including financial support amounting to about \$2.5 million, within the framework of formalized support programmes, and Italy offered to provide support through such a programme. Other Member States (notably Austria, Bulgaria, Czechoslovakia, Finland, the German Democratic Republic, Hungary, the Netherlands, Romania, Sweden and Switzerland) continued to contribute through research and development agreements, contracts and test programmes. Further testing of safeguards equipment for CANDU reactors was carried out in Argentina, Canada, India, the Republic of Korea and Pakistan. Argentina continued to co-operate with the Agency in the development of a safeguards approach for heavy-water production plants.

3/6. 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.

377. Two training courses on SSACs were held: a first regional course for Member States in the Far East, South-East Asia and the Pacific region was held in Japan and attended by participants from eight countries, and an advanced training course for countries with significant nuclear activities held in the United States was attended by participants from 19 countries.

The Agency's resources

Manpower

378. There was no net increase in the number of posts foreseen for the inspectorate in the budget for 1985 but, thanks to improvements in recruitment procedures which led to the more rapid filling of vacancies, the number of available inspector (including inspection assistant) man-years rose from 154.1 to 171.9 - an increase of 11.6%. However, delays in the designation of new inspectors again hampered the efficient utilization of such inspectors, with the result that there was an increase of only 4% in the available man-years of designated inspectors (and inspection assistants) for carrying out inspections at facilities. Even though the available inspector man-years increased, it was possible to carry out only 72.9% of the planned routine inspection effort. It became clear that, in order to achieve a significant increase in this percentage, further increases in the number of inspector posts would be necessary. There were also no new Professional posts foreseen for safeguards staff outside the inspectorate in the 1985 budget. However, such staff continued to be of vital importance to safeguards effectiveness.

Equipment

379. Expenditure on equipment and supplies, at \$3.9 million, was \$400 000 more than in 1984, but it nevertheless represented a budget underrun of \$1.3 million, due mainly to a delay in the need for the acquisition of equipment required for the application of safeguards at a heavy-water production plant.

Table 4

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

	Number of States		
	1983	1984	1985
NNW States with safeguards applied under NPT and/or Tlatelolco agreements	40	41	42
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	51	52	53
NW States with voluntary-offer agreements in force	3	3	4
Other NW States	2	2	1
Total number of States with significant nuclear activities	56	57	58

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

Table 5

Approximate quantities of material subject to Agency safeguards
except that covered by voluntary-offer agreements with NW States
(at the end of 1985)

Type of material	Quantity of material (t)		Quantity in SQ
	in NNW States	in NW States	
<u>Nuclear material</u>			
Plutonium ^{a/} contained in irradiated fuel	123.0	7.5	16 330
Separated plutonium	7.1	0.8	990
HEU (equal to or greater than 20% uranium-235)	12.3	0	270
LEU (less than 20% uranium-235)	20 500	1 060	6 680
Source material ^{b/} (natural or depleted uranium and thorium)	30 000	0	2 430
<u>Total significant quantities</u>			26 700
<u>Non-nuclear material^{c/}</u>			
Heavy water	1 432	0	- <u>d/</u>

a/ The quantity includes an estimated 46.2 t (5775 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 6

Approximate quantities of material subject to Agency safeguards^{a/}
 in installations designated for inspection under
 voluntary offer agreements with NW States
 (at the end of 1985)

Type of nuclear material	Quantity of material (t)	Quantity in SQ
Plutonium contained in irradiated fuel	24.6	3070
Separated plutonium	1.1	131
LEU (less than 20% uranium-235)	2 986	501
Source material (natural or depleted uranium and thorium)	13 044	714
TOTAL		4416

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

Table 7

Installations in NNW States under safeguards or containing
safeguarded material at 31 December 1985

Installation category	Number of installations		
	INFCIRC/153 ^{a/}	INFCIRC/66/Rev.2	Total ^{b/}
A. Power reactors	146	26	172 (165)
B. Research reactors and critical assemblies	151	26	177 (174)
C. Conversion plants	4	2	6 (6)
D. Fuel fabrication plants	28	9	37 (38)
E. Reprocessing plants	4	2	6 (6)
F. Enrichment plants	5	0	5 (4)
G. Separate storage facilities	28	2	30 (27)
H. Other facilities	39	2	41 (40)
I. Other locations	385	28	413 (415)
J. Non-nuclear installations	0	2	2 (1)
TOTALS	790	99	889 (876)

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

^{b/} Numbers for 1984 are indicated in parentheses for comparison.

Table 8

Installations in NW States under INFCIRC/66/Rev.2
safeguards agreements or designated for inspection
under voluntary-offer agreements at the end of 1985

Installation category	Number of installations		
	INFCIRC/66/ Rev.2	Voluntary offer	TOTAL ^{a/}
A. Power reactors	0	3	3 (2)
B. Research reactors and critical assemblies	0	1	1 (0)
D. Fuel fabrication plants	0	1	1 (1)
F. Enrichment plants	0	2	2 (2)
G. Separate storage facilities	2	1	3 (5 ^{b/})
TOTAL	2	8	10 (10 ^{b/})

^{a/} Numbers for 1984 are indicated in parentheses for comparison.

^{b/} In addition, one storage facility was safeguarded under an INFCIRC/66/Rev.2-type agreement for only part of 1984.

Table 9

**Situation on 31 December 1985 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)	INF/CIRC (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
Belize	9 August 1985		
Benin	31 October 1972		
Bhutan	23 May 1985		
Bolivia ^{b/}	26 May 1970	Signed: 23 August 1974	
Bots ^{c/}	28 April 1969		
Brun ^{d/} arussalam	25 March 1985		
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 ^{f/}	3 March 1970	In force: 22 November 1979	278
Côte d'Ivoire	6 March 1973	In force: 8 September 1983	309
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 People's Republic of Korea	12 December 1985		
Democratic Yemen	1 June 1979		
Denmark ^{g/}	3 January 1969	In force: 21 February 1977	193
Dominica	10 August 1984		
Dominican Republic ^{h/}	24 July 1971	In force: 11 October 1973	201
Ecuador ^{i/}	7 March 1969	In force: 10 March 1975	231
Egypt	26 February 1981	In force: 30 June 1982	302
El Salvador ^{j/}	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 ^{k/}	11 March 1970	Accession: 17 December 1981	193
Grenada	19 August 1974		
Guatemala ^{l/}	22 September 1970	In force: 1 February 1982	299
Guinea-Bissau	20 August 1976		
Haiti ^{m/}	2 June 1970	Signed: 6 January 1975	
Holy See	25 February 1971	In force: 1 August 1972	187
Maldives ^{n/}	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
Jamaica ^{b/}	5 March 1970	In force: 6 November 1971	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		
Kiribati	18 April 1985		
Korea, Republic of	23 April 1975	In force: 14 November 1975	236
Kuwait ^{a/}			
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
Seychelles	12 March 1985		

(1)	(2)	(3)	(4)
Sierra Leone	26 February 1975	Signed: 10 November 1977	
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 ^{d/}			
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 ^{d/}			
Yugoslavia	5 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. Upon Greenland's accession from EURATOM as of 31 January 1985, the Agreement between the Agency and Denmark (INFCIRC/176) re-entered into force as to Greenland.
- 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.

**Agreements providing for safeguards, other than those
in connection with NPT,
approved by the Board as of 31 December 1985**

Party(ies) ^{a/}	Subject	Entry into force	INPCIRC
(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/}	JNR-3	24 March 1959	3
Malaysia ^{b/}	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	PHR 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/}	PHR-1 Reactor	28 September 1966	88
Romania ^{b/}	TRIGA Reactor	30 March 1973	206
	Experimental fuel elements	1 July 1983	307
Spain	Coral-1 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 ^{b/}	Fuel for research reactor	1 July 1983	308
Yugoslavia ^{b/}	TRIGA-II Reactor	4 October 1961	32
	Krsko 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
	Vandellós Nuclear Power Plant	11 May 1981	292
	Specified nuclear facilities	11 May 1981	291 ^{a/}
United Kingdom	Nuclear material	14 December 1972	175
Viet Nam	Research reactor and fuel therefor	12 June 1981	293

^{a/} Amended in 1985 to cover specified nuclear facilities. The amendment entered into force on 24 September 1985 (INPCIRC/29/Mod.1).

Party(ies) ^{a/}	Subject	Entry into force	INFCIRC
<u>(c) Tlatelolco Treaty</u>			
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
<u>(d) Agreements concluded with nuclear-weapon States on the basis of voluntary offers</u>			
France	Nuclear material in facilities submitted to safeguards	12 September 1981	290
Union of Soviet Socialist Republics	Nuclear material in facilities selected from list of facilities provided by the U.S.S.R.	10 June 1985	327
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
<u>(e) Other agreements</u>			
Argentina/United States of America		25 July 1969	130
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 ^{d/}		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 ^{d/}		28 February 1972	161
Turkey ^{d/} /United States of America ^{d/}		5 June 1969	123
Venezuela ^{d/} /United States of America ^{d/}		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.

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 11

**Facilities under Agency safeguards or containing safeguarded
material on 31 December 1985**

A. Power reactors

State ^{a/}	Abbreviated name of installation	Location	Subsidiary arrangements in force
Argentina	Atucha NP	Lima	X
	Embalse PR	Embalse	-
Austria	Tullnerfold	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
	Kozloduy-III, Unit 1	Kozloduy	-
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	-
	EDU-1, Unit 2	Dukovany	-
	V-1, Unit 1	Bohunice	X
	V-1, Unit 2	Bohunice	X
	V-2, Unit 1	Bohunice	X
	V-2, Unit 2	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	AVR	Jülich	-
	GKN	Neckarwestheim	x
	KFK-MZFR	Eggenstein-Leopoldshafen	x
	KKB	Brunsbüttel	x
	KKG	Grafenrheinfeld	-
	KKI	Ohu	x
	KKK	Geesthacht-Krömmel	-
	KKP-1	Philippsburg	x
	KKS	Stade	x
	KKU	Stadland	x
	KKW Mülheim-Kärlich	Mülheim-Kärlich	-
	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
	KWO	Obrighoim	x
	KWW	Würgassen	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 Veditto	x
	ENEL	Caorso	x
	PERMI	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	x
	Fukushima Dai-Ni-3	Naraha-Fukushima	x
	Genkai-1	Kyushu	x
	Genkai-2	Kyushu	x
	Hamaoka-1	Hamaoka-cho	x
	Hamaoka-2	Hamaoka-cho	x
	Ikata-1	Nishiura-gun	x
	Ikata-2	Nishiura-gun	x
	JPDR	Tokai-Mura	x
	Kashiwazaki-1	Niigata	x

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	x
	Sendai-1	Sendai	-
	Sendai-2	Sendai	-
	Shimano-1	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-1	Tsuruga	x
	Tsuruga-2	Tsuruga	x
Korea, Republic of	Kori-1	Pusan	x
	Kori-2	Pusan	x
	Kori-5	Pusan	-
	Korea Nuclear Unit 6	Yangsam	x
	Korea Nuclear Unit 7	Pusan	-
	Wolsung-1	Ulsan	x
Mexico	Laguna Verde 1	Alto Lucero	-
	Laguna Verde 2	Alto Lucero	-
Netherlands	GKN	Dordrecht	x
	PZEM	Borssele	x
Pakistan	KANUPP	Karachi	x
Philippines	PNPP-1	Morong, Bataan	x
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	Almonacid de Zorita	x
	Lemoniz-1	Lemoniz	x
	Lemoniz-2	Lemoniz	x
	Santa Maria de Garona	Santa Maria de Garona	x
Sweden	Vandellös	Vandellös	-
	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	Bezau	x
	KKB-II	Bezau	x
	KKG	Gösgen-Dänikon	x
	KKL	Leibstadt	-
	KKM	Mühleberg	x
Union of Soviet Socialist Republics	Novo Voronezh Unit 5	Novo Voronezh	-
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	Vionna	x
Bangladesh	Atomic Energy Research Est.	Ganakbari Savar Dhaka	-
Belgium	BR1-CEN	Mol	x
	BR2-CEN	Mol	x
	BRO2	Mol	x
	CEN-Venus	Mol	x
	Thotis	Gent	x
Brazil	LEAR-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
	Slowpoke-Kingston	Kingston	-
	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-O	Rez	x
	SR-OD	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
Egypt	Nuclear Research Centre	Inshas	x
Finland	Triga II	Otaniemi	x

State ^{a/}	Abbreviated name of installation	Location	Subsidiary arrangements in force
German Democratic Republic	RAKE	Rosendorf	x
	RRR	Rosendorf	x
	Training Reactor AKR	Dresden	x
	Training research reactor	Zittau	x
	WWR-S M	Rosendorf	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
	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-1	Baghdad Tuwaitha	x
	Tamuz-2	Baghdad Tuwaitha	x
Israel	IRR-1	Soreq	x

State ^{a/}	Abbreviated name of installation	Location	Subsidiary arrangements in force
Italy	AGN-201	Palermo	x
	CESNEF-L54	Milan	x
	ESSOR	Ispra	x
	Impianto Pec del CNR	Brasimone, Bologna	-
	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	Centro for Nuclear Sciences	Kingston	-
Japan	DCA	Oarai-Machi	x
	FCA	Tokai-Mura	x
	KTC	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
	NAIG-CA	Kawasaki-ku	x
	NSRR	Tokai-Mura	x
	Rikkyo University R.R.	Nagasaki	x
	TCA	Tokai-Mura	x
	TODAI	Tokai-Mura	x
	TTR	Kawasaki-shi	x
	VHTRC	Tokai-Mura	x
Korea, Republic of	Triga II	Seoul	x
	Triga III	Seoul	x
	Kyung-Hoe 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
Norway	HBWR-Halden	Halden	x
	JEEP-II	Kjeller	x

State ^{a/}	Abbreviated name of installation	Location	Subsidiary arrangements in force
Pakistan	PARR	Rawalpindi	x
Peru	RP-O	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-O	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
Union of Soviet Socialist Republics	IR-8 Research Reactor	Moscow	-
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	x
	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	Varennnes	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	x
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
	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 Vison 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	-
	URENCO Deutschland, UFA-1	Gronau	-
Japan	PNC Pilot Enrichment Plant	Ningyo	x
Netherlands	URENCO Nederland	Almelo	x
	Ultra-Centrifuge*	Almelo	-
United Kingdom	BNFL Centrifuge plant and associated storage	Capenhurst	x
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	x
	Belgoprocesu	Mol	x
Canada	Bruce A	Tiverton	x
	Bruce B	Tiverton	-
	CRNL	Chalk River	x
	Long term storage at CRNL	Chalk River	-
	Pickering	Pickering	x
	WNRE	Pinawa	x
Denmark	Risø Store	Roskilde	x
France	COGEMA UP2 spent fuel storage ponds	La Hague	-
German Democratic Republic	Interim storage facility for spent fuel assemblies	Lubmin	-
Germany, Federal Republic of	Braunkohle	Werraeling	x
	Bundeslager	Wolfgang	-
	Exxon Nuclear UF ₆ Lageranlage	Lingen	x
	KFA Jülich Lager f. austr. AVR Kugeln	Jülich	-
	KFK-FR-2	Eszenstein-Loopoldshafen	-
	Lager II Loose	Landesbergen-Loose	-
	Lageranlage für abgereichertes Uran	Kelkar	-
	Transnuklear Halle	Hanau	-
	Urananlage	Birkenfeld	x
Iraq	Separate storage facility	Baghdad Tuwaltha	x
Italy	Avogadro	Saluggia	-
	Deposito Prodotti Uraniferi	Bosco Marengo	x
	Ispra Central Storage	Ispra	x
Japan	KUFS	Kyoto	x
Luxembourg	International Metals S.A.	Luxembourg-Dommeldange	-
Pakistan	Storage at Government depot	Karachi Malir	x
Portugal	Instalacao do Amazonagone	Sacavem	x
Sweden	Central long term storage	Oskarshamn	-
Switzerland	Diorit Storage	Würenlingen	x
United Kingdom	Sellafield Pu-storage	Sellafield	x
	Oxide Fuel Storage Pond	Sellafield	x

H. Other facilities

State ^{a/}	Abbreviated name of installation	Location	Subsidiary arrangements in force
Argentina	Labo. de Calificacion	Constituyentes	-
Australia	Research Laboratory	Lucas Heights	x
Belgium	BCM	Geol	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	Roz	x
Denmark	Hotcell Plant	Roskilde	x
German Democratic Republic	Uran Technikum	Rosendorf	-
Germany, Federal Republic of	KFA-Lab	Jülich	-
	KFA-heisse Zellen	Jülich	-
	KFK-IK/1	Eggenstein-Leopoldshafen	-
	KFK-heisse Zellen	Eggenstein-Leopoldshafen	x
	KFK/IHCH	Eggenstein-Leopoldshafen	x
	KFK/IMP3	Eggenstein-Leopoldshafen	x
	KWU-heisse Zellen	Karlstein	x
	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
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	Studsвик	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 Heavy water storage	Arroyito Buenos Aires	- -

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/ 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.

International Nuclear Information System (INIS)

380. In 1985, the input to the INIS data base totalled about 86 500 documents -- second only to the 1983 input (92 113 documents). The size of the data base had risen to 966 500 records by the end of the year.

381. Besides the annual consultative meeting of INIS Liaison Officers, a general review was carried out of the operations of INIS during the 15 years since its inception. A start was made with the implementation of the recommendations resulting from the review.

382. In February, a consensus was reached on certain outstanding aspects of the membership arrangements for INIS.

383. In November, the Fifth Advisory Committee for INIS considered several matters of importance for the further development of INIS.

384. An INIS training seminar held in Vienna was attended by 23 participants from 19 Member States and a user organization.

385. Once again, the INIS Clearinghouse distributed an unusually large number (600 000) 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 the year, the total collection of microfiche masters numbered 181 000 documents (250 000 microfiches).

386. Thirty-three Member States and one international organization used the 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.

Table 12

INIS statistics		
	<u>1984</u>	<u>1985</u>
Number of records added to the data base	73 362	86 529
Number of microfiches distributed	530 000	700 000
Number of full microfiche subscriptions	37	37
Number of participating Member States	73	74
Number of participating international organizations	14	14
Direct access usage (connect hours)	1 896	2 046

Agricultural Information System (AGRIS)

387. Preparations were completed for making utilization of the multilingual indexing vocabulary AGROVOC mandatory, with effect from the beginning of 1986

(before that, its utilization by participating countries was optional), and for introducing a new categorization scheme.

388. National bibliographies were produced for Egypt, India and Nepal.

389. The publication started of a bi-monthly specialized bibliography on wheat, barley and triticale produced in collaboration with the International Maize and Wheat Improvement Center, Mexico. A specialized bibliography on forestry was produced on the occasion of the World Forestry Congress held in Mexico City in June.

Computer services

390. At the central computer site, the IBM 3032 computer was replaced by an IBM 3083EX, which has a larger capacity. Also at the central site, the IBM 3081 computer was connected to an international packet-switching telecommunications network in order to provide Member States with more reliable access to the Agency's computer facilities. In November, the central computing facility started to provide a round-the-clock service, primarily in order to permit handling of the large amount of printing work processed through the central computers.

391. Experts from two further countries (Poland and Turkey) made use of the central computing facility for reactor safety analyses. A clearing-house for research reactor information (the Research Reactor Data Base) became operational. The inclusion of UNDP projects in the computer-based monitoring system for technical co-operation was completed and the system facilities for technical co-operation equipment administration were upgraded.

392. The provision of information handling and distribution services received increased attention; by the end of the year, some 400 work stations (word processors, personal computers, terminals connected to the central computers) had been installed and the equipment users trained. Work began on installing a direct telecommunications line between United Nations Headquarters in New York and the Agency's central computing facility, mainly for the use of the United Nations units based in Vienna. Services were provided to the Division of Languages in connection with the installation of a specialized terminology data base developed by the EEC.

393. Utilization of the two central computers increased by 35%. About 20% of the total workload was for other United Nations organizations located at the Vienna International Centre.

394. Following the adoption - in 1984 - of a policy for the acquisition and use of personal computers, the guidelines were approved for the standardization of non-intelligent terminals accessing the central computers; replacement of obsolete equipment began on the basis of those guidelines.

Library services

395. The ViC Library continued to develop applications of computer techniques aimed at increasing efficiency and providing a more cost-effective service.

396. Information services to users were improved through the installation of a personal computer giving more reliable access to over 300 external data bases.

397. The number of volumes in the book collection increased by 3380 to 67 350; the number of current titles in the journal collection stood at 3690 by the end of the year. The collection of United Nations documents increased by 50 000 items and that of technical reports by 15 000 items.

398. The Library lent 12 700 books and 340 films and dealt with 9300 reference questions. Current awareness bulletins covering the tables of contents of 7000 journal issues were distributed in 18 000 copies.

Scientific journals

399. Twelve regular issues of "Nuclear Fusion" were published. The ninth issue, marking the journal's 25th anniversary, contained 70 historical surveys of the major lines of nuclear fusion research contributed by leading scientists in the field. Among the contributions was the first comprehensive survey published outside China of fusion activities in that country.

400. Data for the 1985-86 edition of the "World Survey of Activities in Controlled Fusion Research" were collected and prepared for publication.

Legal AffairsAmendment to Article VI.A.1 of the Statute

401. An amendment to Article VI.A.1 of the Agency's Statute providing for the designation by the Board of Governors each year of the ten - instead of nine - Member States "most advanced in the technology of atomic energy including the production of source materials" had been accepted by 30 Member States by the end of the year. The amendment will come into force when it has been accepted by two thirds of the Member States in accordance with their respective constitutional requirements.

Physical protection

402. The Convention on the Physical Protection of Nuclear Material[14] was signed by one more State - Niger - and ratified by five more States - Brazil, Guatemala, Norway, Paraguay and Turkey. By the end of the year, 39 States and one regional organization had signed the Convention and 15 States had ratified it. The Convention requires 21 ratifications or acceptances for its entry into force.

Privileges and immunities

403. Italy accepted the Agreement on the Privileges and Immunities of the Agency[15] on 20 June 1985. By the end of the year, 57 Member States were parties to the Agreement.

Headquarters seat agreements

404. On 20 December, the Agency, the United Nations and UNIDO exchanged notes with Austria providing for the continued application of the existing agreements regarding the Headquarters area common to the Agency and the other organizations located at the VIC[16] pending the conclusion of new Headquarters agreements between Austria and UNIDO; such new agreements are required on account of the conversion of UNIDO into a specialized agency as of 1 January 1986.

Regional seminar on nuclear law

405. A regional seminar on nuclear law and safety regulations for developing countries in Africa was held in Cairo, Egypt, in May with the co-operation of the Egyptian Atomic Energy Authority and its Nuclear Regulatory and Safety Centre. The seminar provided for an overview of the scope and components of nuclear legislation and for an exchange of information on practices, experience and current developments in the regulation of peaceful nuclear

[14] Reproduced in document INFCIRC/274/Rev.1.

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

[16] Reproduced in document INFCIRC/15/Rev.1/Add.1, parts II, IV, V and VI.

activities. More than 40 participants from eleven Member States participated in the seminar, for which lecturers were provided cost-free by France, the Federal Republic of Germany, Spain and the United States.

Advisory services

406. Advice on the framing of legislation connected with the implementation of nuclear power programmes was provided to Egypt and Morocco. Jamaica was assisted in the elaboration of an act regulating the development of nuclear energy for peaceful purposes.

Finance

407. The Regular Budget total for 1985 was \$95 025 000, of which \$87 340 000 was to be financed from contributions made by Member States on the basis of the 1985 scale of assessment, \$3 414 000 from income from work for others and \$4 271 000 from other miscellaneous income.

408. The appropriation sections were based on a rate of exchange of 19.50 Austrian schillings to the United States dollar. Throughout 1985, however, the mean United Nations operational rate of exchange was AS 20.57, resulting in a reduction of the estimated requirements by \$3 757 000.

409. The actual expenditure in 1985 amounted to \$89 093 216, resulting in an unencumbered balance of \$5 931 784, of which \$3 757 000 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 \$11 662 018, compared with \$16 624 918 in 1984.

410. The target for voluntary contributions to the Technical Assistance and Co-operation Fund in 1985 was established at \$26 million. At the end of the year, \$23 255 051 had been pledged by Member States in support of the technical assistance programme. Net new obligations incurred during 1985 amounted to \$26 514 272.

411. A total of \$14 598 893 was offered in extra-budgetary contributions from Member States, United Nations and other international organizations during 1985. Of this amount, \$8 497 623 was for technical assistance projects, \$3 023 053 was in support of safeguards, \$515 642 was for projects in the field of food and agriculture, and \$444 264 was in support of RCA. The remaining \$2 118 311 was in support of various other projects implemented by the Agency.

Public Information

412. During 1985, 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", the Agency's quarterly magazine, was distributed (in English, French, Russian and Spanish) to about 22 000 government and industry officials, journalists, scientists, researchers and members of the general public in over 160 countries.

413. The Agency mounted 15 exhibitions at the VIC and the Hofburg Congress Centre and at meetings and conferences held in Member States. Staff members lectured to nearly 50 groups of visitors to the VIC on the work of the Agency.

General Services

414. Close co-ordination was maintained with the other United Nations organizations located at the VIC on all questions relating to the operation of the VIC complex and the use of common areas.

415. Technical and engineering services were provided in connection with the replacement of the main agricultural building at the Seibersdorf Laboratory, where construction work proceeded on schedule. A survey was carried out in connection with the provision, by the Monegasque authorities, of further temporary premises for the International Laboratory of Marine Radioactivity in Monaco.

416. The introduction of procedures designed to facilitate records management and information retrieval was completed. A new method of long-distance telephone call cost control and redistribution was introduced, with a subsequent reduction in related overhead expenses. The computerized telex system installed at the end of 1984 made it possible to cope with a 15% increase in the volume of messages without additional manpower and contributed to a reduction in the cost per telex handled.

417. Purchases of scientific and non-scientific equipment and supplies and expenditures in connection with scientific and maintenance contracts amounted to around \$12.7 million; nearly 3300 procurement actions were involved.

418. Assistance in finding accommodation and advice relating to housing problems were provided to staff members of the international organizations located at the VIC and persons accredited to these organizations. More than 400 lease contracts were concluded with the help of the VIC Housing Service.

419. The Commissary, with a range of around 5300 articles, served about 7500 households. Total sales amounted to approximately AS 270 million.

Publishing and Printing Services

420. Almost 130 separate books or journal issues were published. The net income to the Agency from the sale of Agency publications was \$884 492, compared with \$864 938 in 1984 and \$1 057 369 in 1983.

421. A detailed study was made of computer-assisted typesetting equipment with a view to its introduction over the next two-three years; it is expected that computer-assisted typesetting will result in greater flexibility and efficiency combined with a maintenance, or even enhancement, of quality.

422. Document and publication printing services continued to be provided also for UNIDO and the United Nations bodies based at the VIC.

423. The output of printed pages in 1985 was 312 million, compared with 297 million in 1984 and 271 million in 1983. Approximately 57% of the output was for organizations other than the Agency; the corresponding figures for 1983 and 1984 were 47% and 57% respectively. The income from services provided for other organizations was \$1.61 million, compared with \$1.45 million in 1984 and \$1.37 million in 1983.

424. At the end of 1985, the number of members of the Secretariat was 1942 - 715 in the Professional and higher categories, 1091 in the General Service category and 136 in the Maintenance and Operatives Service category.[17]

425. Among the 5/6 staff members in posts subject to geographical distribution, 79 nationalities were represented.

426. The second traineeship programme for graduates and junior professionals from developing areas, which began in October 1984, was completed in September 1985; 15 trainees participated. The aim of the traineeship programmes is to qualify the trainees for employment with the Agency or for relevant work in their home countries.

427. A performance appraisal system aimed at increasing efficiency and effectiveness was introduced.

428. A study was made of the data protection legislation in six countries and, on the basis of the results, policies and procedures were promulgated for the safekeeping of confidential personnel information.

429. 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 1985 the emphasis continued to be on questions concerning the post adjustment system, pensionable remuneration and pensions.

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

[17] These figures represent: Members of the Secretariat occupying Manning table posts (1499) or charged to Manning table posts (86), to the temporary assistance fund (152) and to consultancy funds (17); officials serving on a reimbursement basis (180) or on secondment (8).

ORGANIZATIONAL CHART

