ANNUAL REPORT

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INTERNATIONAL ATOMIC ENERGY AGENCY

CONTENTS

ANNEXES

List of abbreviations

Agency	International Atomic Energy Agency
CINDA	Computer Index of Neutron Data
CRP	Co-ordinated Research Programme
ECAFE	United Nations Economic Commission for Asia and the Far East
EURATOM	European Atomic Energy Community
FAO	Food and Agriculture Organization of the United Nations
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICRP	International Commission on Radiation Protection
INIS	International Nuclear Information System
MHD	Magnetohydrodynamics
NEA	Nuclear Energy Agency of the Organisation for Economic Co-operation and Development
NPT	Treaty on the Non-Proliferation of Nuclear Weapons (reproduced in document INFCIRC/140)
SIDA	Swedish International Development Authority
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
WHO	World Health Organization

NOTE

All sums of money are expressed in United States dollars.

INTRODUCTION

General

1. The rise in the price of crude oil is accelerating the growth of nuclear power capacity in many countries. This affects most of the Agency's activities, particularly those relating to safety and environmental protection and nuclear power itself. It will also affect the Agency's technical assistance work, and, subsequently, its safeguards activities.

2. During 1973, nuclear power plants with a total capacity of nearly 60 000 MW were ordered. In the annual report for 1972-73 it was estimated that installed nuclear capacity throughout the world would reach about 315 000 MW by 1980.[1] This estimate as well as those for 1990 and the year 2000, may be substantially exceeded. There is also a growing interest in the use of nuclear energy as a source of process heat in industry.

3. If nuclear power is to fulfil these new expectations, a great effort must be devoted to solving the environmental problems that could be caused by a manifold increase in its use, and especially the problems of nuclear waste management. It is also essential to improve public understanding of these matters.

4. The increase in oil prices affects in particular the prospects for the use of nuclear energy in the developing countries. Not only are the standard (600-1000 MW) sizes of nuclear plant now competitive in most situations, but considerably smaller nuclear stations might prove to be competitive, if they were available. Tentative estimates suggest that the installation and use of 216 000 MW of nuclear capacity will be economically feasible in the developing countries during the period 1980-1990, as compared with last year's estimate of 152 000 MW. The Agency is revising the projections made in the market survey for nuclear power carried out last year in 14 developing countries[2], and is assisting Member States in their nuclear power planning studies, using the methodologies developed for the market survey.

Technical co-operation activities

5. The changing energy situation will have a marked influence on the Agency's technical co-operation programme. The Agency will be called upon to provide more assistance in detailed feasibility studies for nuclear power plants, to advise developing countries on all aspects of the implementation of nuclear power projects and to help in training specialized personnel.

6. It is to be foreseen that Member States will give high priority to nuclear power in the requests for assistance which they submit to UNDP. It is necessary to try to ensure that adequate funds will also be available for the Agency's own technical assistance programme, a matter to which the Board has given particular attention during the period covered by this report.[3] In both February and June it considered a report by the Director General on a study made by the Secretariat of the financing of technical assistance, and decided to present that report to the General Conference[4]. The Board at

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[1] See document GC(XVII)/500, para. 12.

[2] For details, see document GC(XVII)/506.

[3] The Director General's report on the provision of technical assistance with special reference to 1973 is submitted to the General Conference as document GC(XVIII)/INF/148.

[4] In compliance with the Conference's request in Resolution GC(XVII)/RES/307, para. 2.

present takes the view that the practice of financing the provision of technical assistance through voluntary contributions to the General Fund will have to be continued until an alternative mode of financing is decided upon. Meanwhile, the Board, in considering annually the level of the target for voluntary contributions for the following year, proposes to take into account, among other things, the need to meet technically sound requests for assistance received from developing Member States as well as the need to compensate for such factors as inflation and fluctuations in exchange rates.

Impact of nuclear energy on the environment

7. The prospect of even larger nuclear power programmes has, if anything, intensified the contoversy about the impact of nuclear technology on the environment. In that context tentative plans were drawn up in February for an expansion of the Agency's work on the development of siting, safety and reliability standards for nuclear power plants, as well as its capacity to give practical help on safety questions to Member States that are introducing the use of nuclear power. Those plans were examined by a group of internationally eminent experts which the Director General convened early in April to advise him with regard to the objectives, scope, timing and estimated cost of the proposed activities, and in June the Board approved expansions of the programmes relating to nuclear power and to nuclear safety and environmental protection, as well as the plans for supplementary training activities in these domains.

8. The Agency is also giving high priority to the problems of nuclear waste management, and a standing technical advisory committee on one of the most important subjects in this field - high-level radioactive and alpha-bearing wastes - held its first meeting in Vienna in March 1974.

9. The Secretariat had also begun the revision of the document setting forth the Agency's health and safety measures[5], which were approved by the Board in 1960, with a view to increasing their practical usefulness to Member States.

10. It will be recalled that last year the Agency had already launched a special programme relating to the environment which was to be financed by voluntary contributions. Member States have now contributed $152 941 to this programme. The Agency has also received the first allocations of funds from UNEP, chiefly to expand the work of the International Laboratory of Marine Radioactivity in Monaco so as to include studies of the effect of certain non-radioactive pollutants on the sea and on marine life.

Agriculture and water resources

11. There are many indications that developing Member States set great store by the programmes that the Agency and FAO are jointly carrying out in applying nuclear science and technology to increase and improve the world's food production, but a shortage of financial resources continues to hamper the expansion of those programmes.

12. In view of the impact of higher energy costs on the price of nitrogen fertilizers and the latters' crucial role in increasing food production, especially in the developing countries, the joint FAO/IAEA research programme designed to assist Member States in establishing the most efficient and economical methods of using such fertilizers has become of even greater interest than formerly.

13. In the first half of 1974, an important decision for the future of food irradiation was taken by WHO, namely to confirm the temporary international acceptance given in 1969 to irradiation as a means for preserving wheat, wheat products and potatoes.

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[5] See document INFCIRC/18.

14. The extent to which isotope hydrology is becoming an accepted tool for the development of water resources was shown by the attendance of almost 200 hydrologists at a symposium that the Agency held on the subject in March 1974 in Vienna. The Agency is continuing its subcontractual work for other United Nations organizations and in 1973 projects were undertaken in six developing countries.

The International Nuclear Information System

15. As is shown in paragraphs 145 to 149 of the present annual report, INIS is developing satisfactorily and the number of items handled increased from 44 000 in 1972-73 to about 60 000 in 1973-74. It is expected that this programme will continue to grow until 1975 and then begin to level off.

Safeguards and the Treaty on the Non-Proliferation of Nuclear Weapons

16. During the period covered by this report two additional non-nuclear-weapon States became parties to NPT, two concluded safeguards agreements with the Agency in connection with NPT and six additional agreements in connection with the Treaty entered into force. The situation on 30 June 1974 was as follows:

Number of non-nuclear-weapon States that have signed NPT	95
Number of non-nuclear-weapon States party to NPT	80
Number of non-nuclear-weapon States that have concluded the required safeguards agreements	44
Number of safeguards agreements in force	32

Furthermore, four safeguards agreements outside the scope of NPT entered into force during the last 12 months, bringing the total to 59. However the application of safeguards under 20 of them is suspended as a result of the implementation of agreements in connection with NPT.

17. The extent to which countries have fulfilled their obligations under the various articles of NPT, including the requirement to conclude a safeguards agreement with the Agency, will doubtless be considered at the Conference on the Review of the Operation of NPT to be held in Geneva in 1975. The degree to which the objectives of the Treaty are fulfilled will obviously be of significance for the peaceful use of nuclear energy throughout the world as well as for the safeguards work and other activities of the Agency.

18. As the figures given in paragraph 16 above show, 55% of the non-nuclear-weapon States party to NPT have concluded the required safeguards agreements with the Agency. It is to be noted, however, that this figure includes almost all the non-nuclear-weapon States party to NPT that have any significant nuclear activities. Negotiations are proceeding with a number of the remaining States.

19. Pending the entry into force of the safeguards agreement signed in April 1973 with EURATOM and its non-nuclear-weapon Member States, progress has been made in preparing the Subsidiary Arrangements and the Facility Attachments that will be needed under the agreement. Substantial progress has also been made in drafting an agreement that would implement the offer of the United States of America to permit the Agency to apply its safeguards to all nuclear activities in the United States, excluding only those having direct national security significance. There have also been exploratory consultations with the United Kingdom of Great Britain and Northern Ireland and the Commission of the European Communities in connection with the similar offer of the United Kingdom.

20. The accelerated growth in the use of nuclear power will obviously increase the safeguards work load of the Agency. This makes it all the more necessary to develop

manpower-saving techniques, procedures and instruments, so that the increase in the staff of the inspectorate may be kept to the minimum.

Questions of particular interest to the United Nations

21. In Resolution 3056 (XXVIII) adopted on 29 October 1973 the General Assembly of the United Nations referred to the technical co-operation activities of the Agency, to its work in ascertaining the nuclear energy requirements of the developing countries and to the progress made in regard to safeguards agreements. Most of the developments described in the previous paragraphs are therefore likely to be of interest to the General Assembly as well as ECOSOC, to both of which this report is also addressed.

22. The Secretary-General has asked the Agency to extend its full support in the preparation of the Conference on the Review of the Operation of NPT and the Secretariat has begun to assemble the material requested by the Preparatory Committee of the Conference.

23. No serious problems of co-ordination have arisen during the period covered by this report with other United Nations organizations. However, both nuclear energy and environmental questions have come very much to the forefront. Numerous international meetings on the various problems arising out of the energy situation are being held or planned and discussions of highly technical matters relating to the impact on the environment have become widespread. In these circumstances, it is particularly necessary that there should be close co-operation between the members of the United Nations family in order to avoid an overlapping of their activities, and to ensure that there are adequate and timely consultations with the Agency, as the technically competent body with regard to nuclear energy and its safety aspects.

Financial and administrative matters

24. The financial problems that the Agency faced last year have been somewhat eased by subsequent realignments in currency exchange rates. Inflation is, however, continuing at an even faster rate than in the past, thus eroding the value of both assessed and voluntary contributions made by Member States. In this context, it is to be noted that the Director General has continued to apply stringent economy measures in the operation of the Agency.

THE AGENCY'S ACTIVITIES

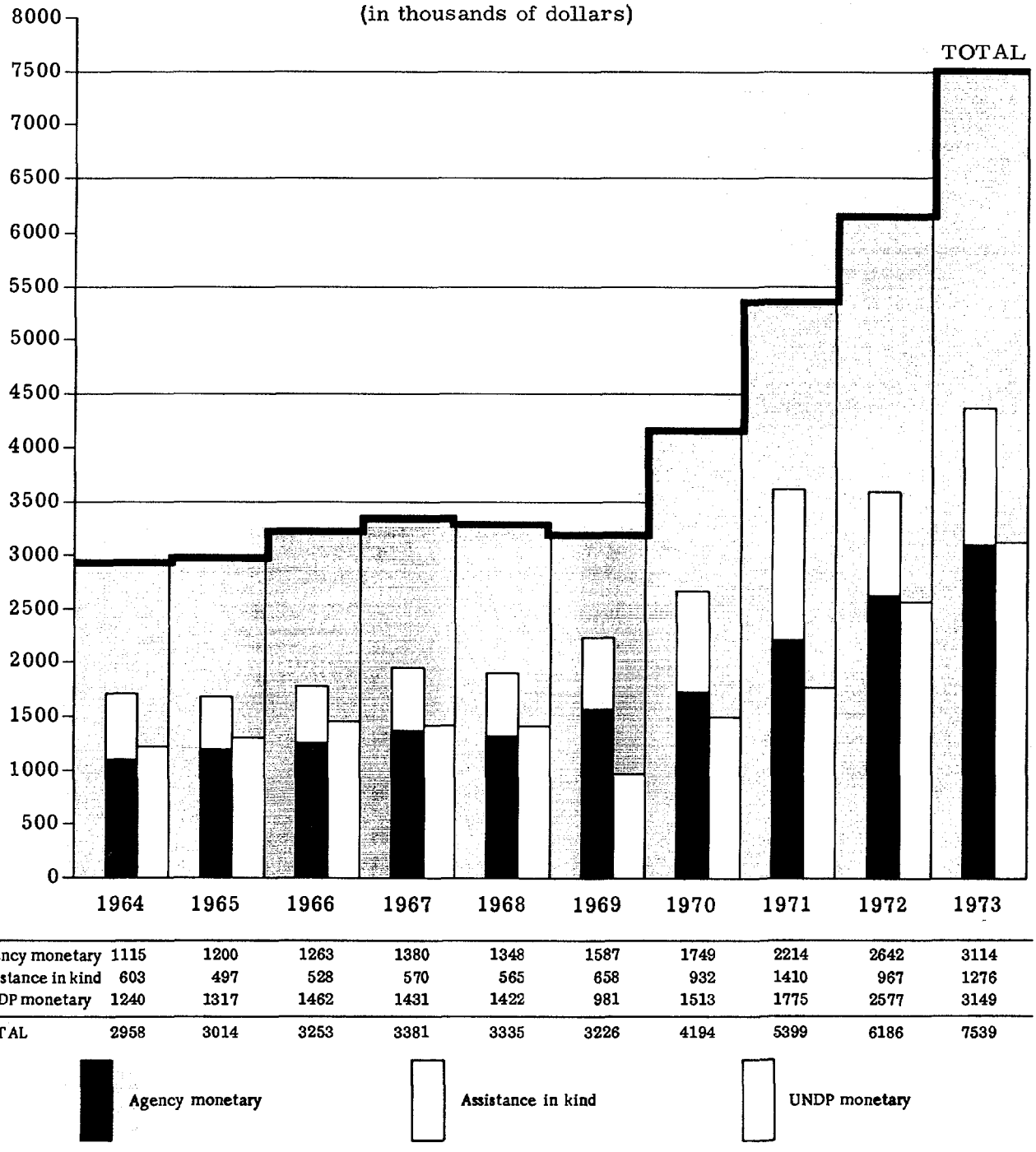
TECHNICAL CO-OPERATION

General

25. In 1973, 7.5 million dollars were available for technical assistance and training compared to 6.2 million dollars in 1972. The resources available for the Agency's technical assistance programmes during the period 1964-1973 are shown in Figure 1 below, while the distribution of technical assistance by field of activity and region in 1973 is illustrated in Figure 2.

FIGURE 1

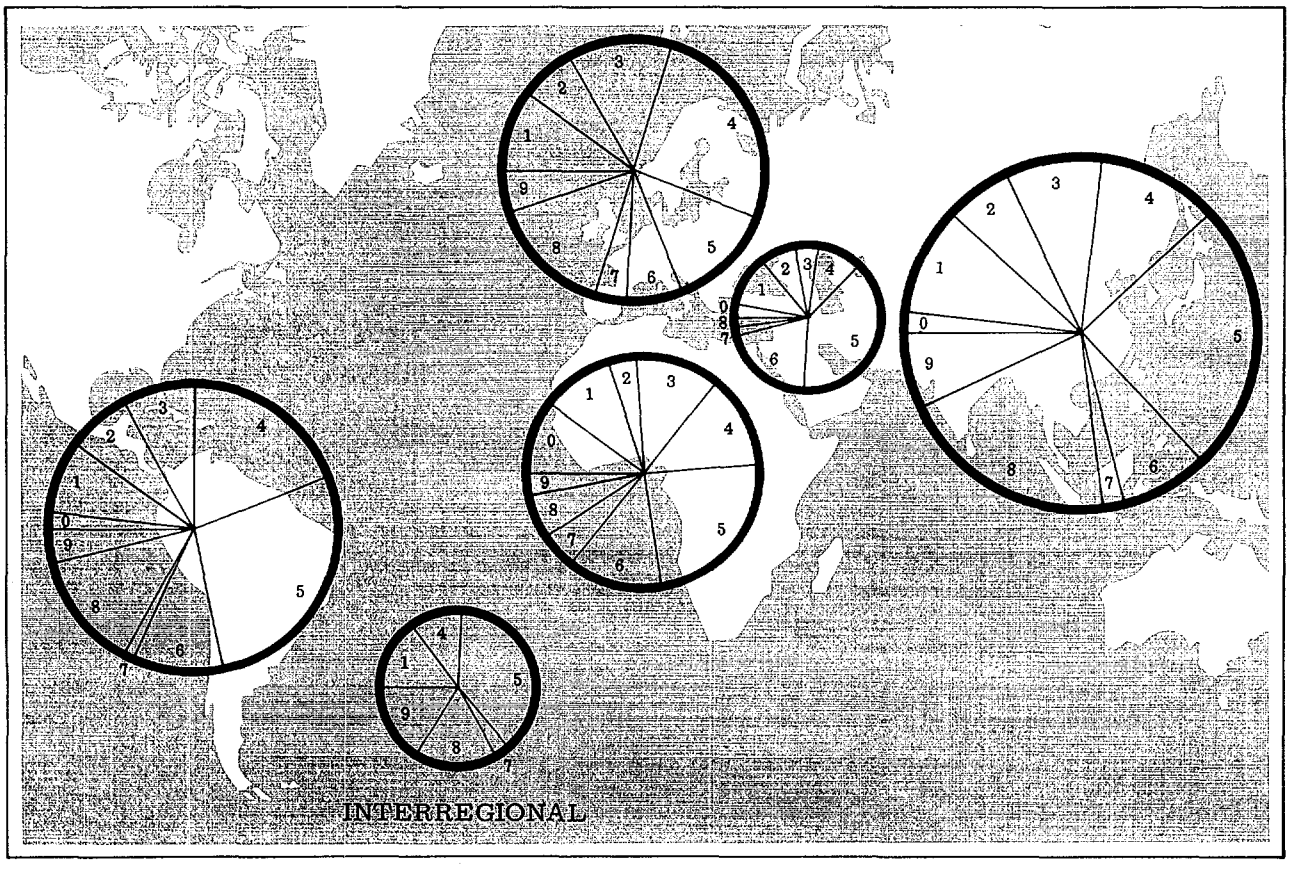
RESOURCES AVAILABLE FOR
AGENCY TECHNICAL ASSISTANCE PROGRAMMES: 1964-1973
(in thousands of dollars)



	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Agency monetary	1115	1200	1263	1380	1348	1587	1749	2214	2642	3114
Assistance in kind	603	497	528	570	565	658	932	1410	967	1276
UNDP monetary	1240	1317	1462	1431	1422	981	1513	1775	2577	3149
TOTAL	2958	3014	3253	3381	3335	3226	4194	5399	6186	7539

FIGURE 2

DISTRIBUTION OF TECHNICAL ASSISTANCE BY FIELD OF ACTIVITY AND REGION: 1973[a/]



SUMMARY

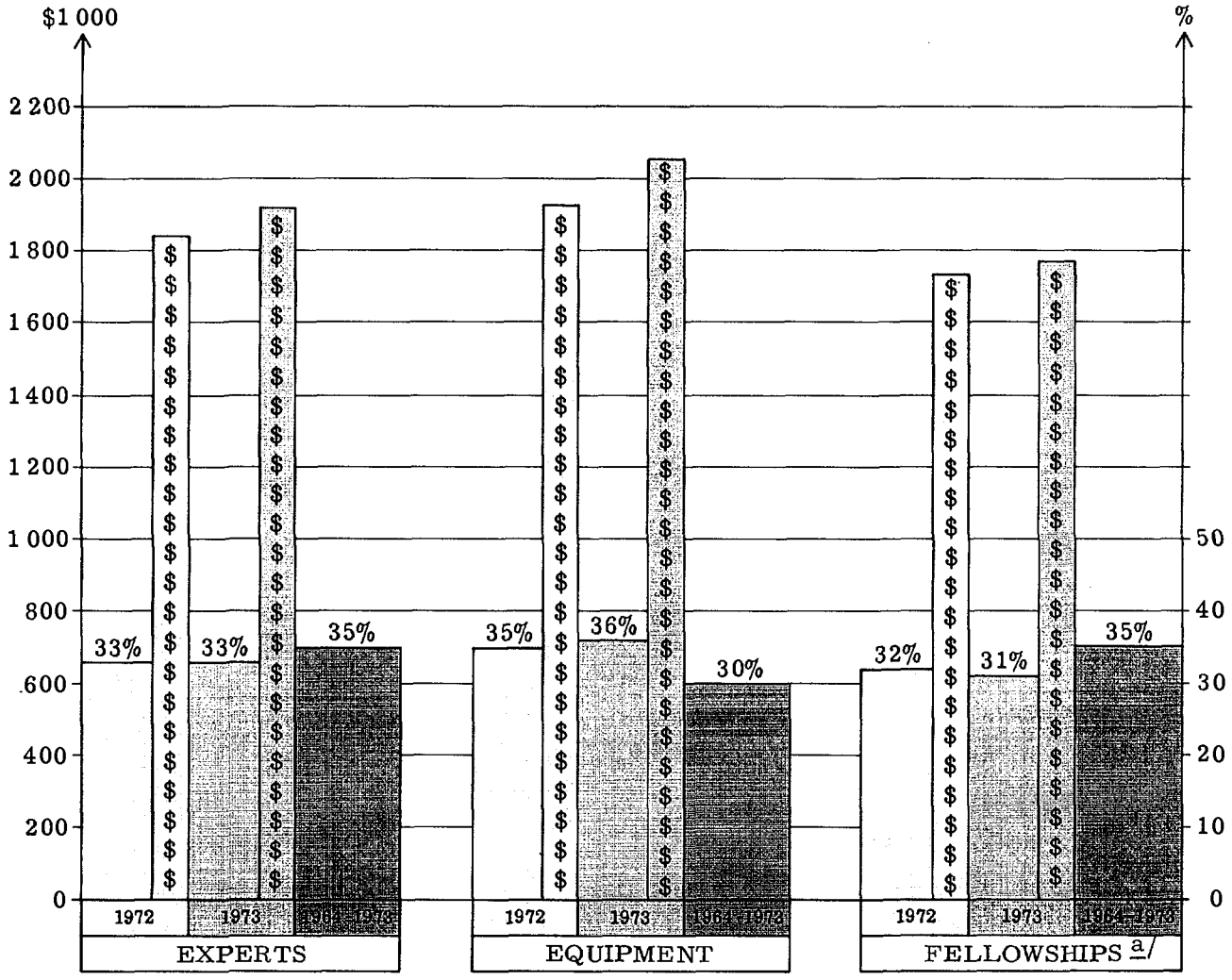
Field of activity		Africa %	Asia and the Far East %	Europe %	Latin America %	Middle East %	Inter-regional %
0 - General atomic energy development		10	2	-	2	3	-
1 - Nuclear physics		10	10	10	8	11	15
2 - Nuclear chemistry		4	6	7	7	8	-
3 - Prospecting, mining and processing of nuclear materials		12	9	13	8	5	-
4 - Nuclear engineering and technology		13	11	26	19	10	11
Application of isotopes and radiation in	5 - Agriculture	24	25	13	28	39	38
	6 - Medicine	13	8	7	10	20	-
	7 - Biology	5	2	4	1	2	3
	8 - Other fields	6	20	15	13	2	17
9 - Safety in nuclear energy		3	7	5	4	-	16
		100%	100%	100%	100%	100%	100%

[a/] For each region, the relative monetary value of the technical assistance provided by the Agency is denoted by the size of the circle superimposed over the region on the map. The size of the segments in each circle indicates the share of total assistance given in the various fields of activity.

26. The distribution of technical assistance by type of assistance during the last two years and during the decade 1964-1973 is illustrated in Figure 3.

FIGURE 3

DISTRIBUTION OF TECHNICAL ASSISTANCE BY TYPE OF ASSISTANCE
(1972, 1973 and 1964-1973)



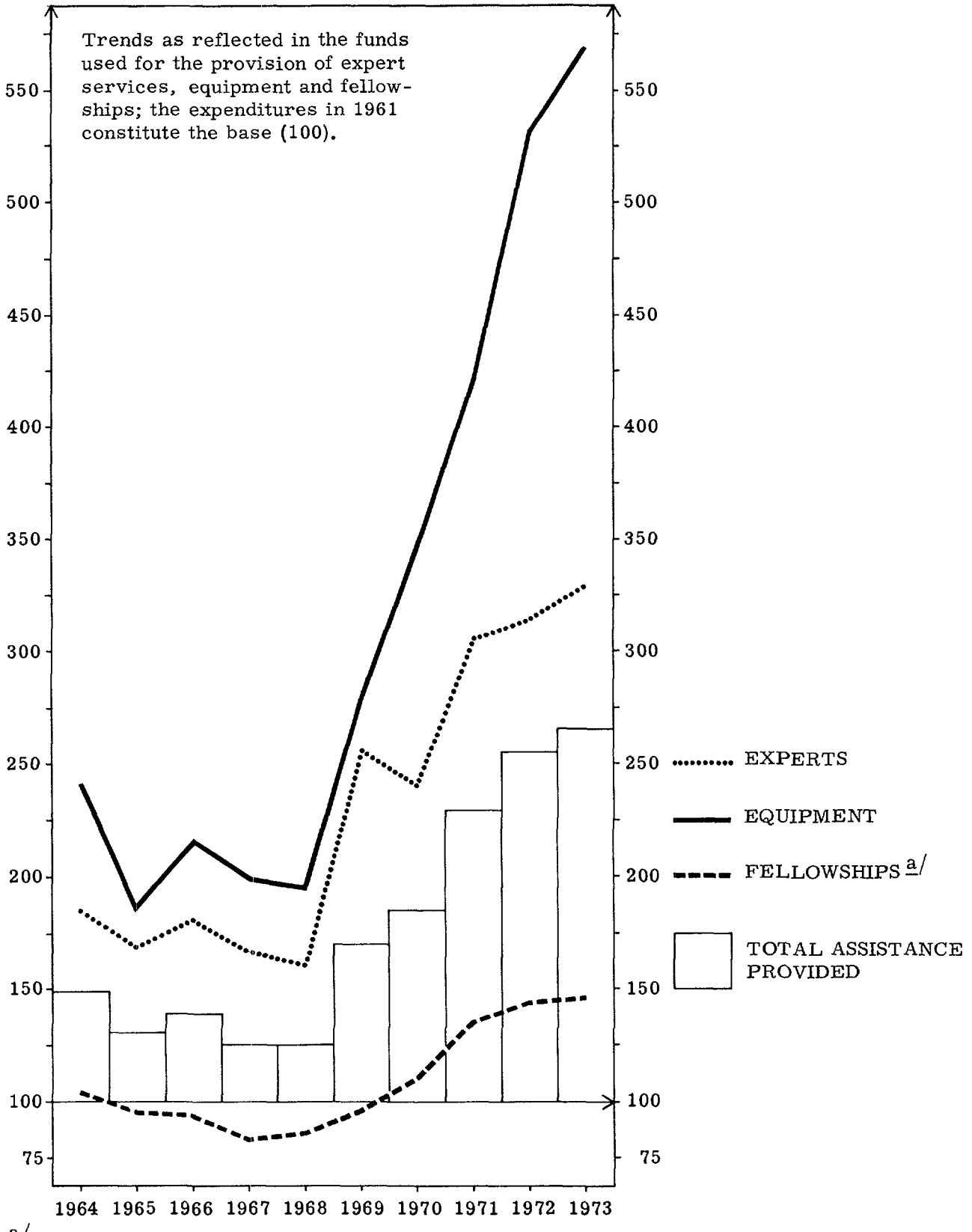
TYPE	1972		1973		1964-1973	
	%	$1 000	%	$1 000	%	$1 000
EXPERTS	33	1 840.2	33	1 926.5	35	13 521.0
EQUIPMENT	35	1 922.1	36	2 055.3	30	11 512.1
FELLOWSHIPS a/	32	1 730.4	31	1 782.6	35	13 233.5
TOTAL	100	5 492.7	100	5 764.4	100	38 266.6

a/ Fellowships include participants in short-term training projects.

27. The trends in the distribution of funds for the provision of the main types of technical assistance are illustrated in Figure 4.

FIGURE 4

TRENDS IN THE TECHNICAL CO-OPERATION ACTIVITIES OF THE AGENCY



a/ Fellowships include participants in short-term training projects.

Training

28. A list of the fellowships made available to the Agency free of charge by Member States in 1973 is given in Annex A. Some of the "Type II" fellowship openings were carried over from a previous year's offer.

29. Table 1 below gives an analysis of the six training courses, two study tours, the seminar and the survey course that the Agency conducted in nine countries from mid-1973 to mid-1974.

Table 1

Regional and interregional short-term training projects

Project	Place and dates	Total number of participants	Source of funds
Interregional training course on the use of radioisotopes and radiation in entomology	Gainesville, Florida, United States 2 July to 24 August 1973	18	Regular programme and the United States
Interregional training course on the use of tracer techniques in industry and environmental pollution studies	Raleigh, North Carolina, United States 9 July to 3 August 1973	21	Regular programme and the United States
International training course on the theoretical principles and practical techniques of isotope hydrology	Heidelberg, Federal Republic of Germany 14 August to 14 December 1973	8	Regular programme and the Federal Republic of Germany
Study tour on radiation dosimetry in medicine and biology	Soviet Union 20 August to 14 September 1973	28	Regular programme
Interregional training course on the maintenance and repair of nuclear electronic equipment	Turin, Italy 3 September to 30 November 1973	15	UNDP
Interregional training course on the use of nuclear techniques in animal parasitology and immunology	Zemun, Yugoslavia 1 to 26 October 1973	20	SIDA
Regional seminar on the use of isotope techniques in water resources inventory, planning and development	Mexico City 12 to 23 November 1973	27	UNDP
Regional survey and briefing course on the technical and economic aspects of nuclear power projects	Bangkok 3 to 18 December 1973	37	UNDP

Project	Place and dates	Total number of participants	Source of funds
Interregional training course on the use of isotopes and radiation techniques in research on soil-plant relationships	New Delhi 4 March to 26 April 1974	20	SIDA
Study tour on the utilization of nuclear research reactors	German Democratic Republic and the Soviet Union 13 May to 11 June 1974	28	Regular programme

UNDP projects

30. On 30 June 1974, the Agency was carrying out the 15 large-scale UNDP projects which are summarized in Table 2 below, compared with nine on the same date in 1973. Three of the projects are for prospecting and development of uranium ore, three involve the use of large radiation sources, and four concern the use of nuclear science in agriculture. The growth in the number of such projects between 1973 and 1974 may be expected to continue in the future in view of the improved prospects for nuclear energy, the increasing demand for uranium and the increasing availability and use of radiation sources in developing countries.

Table 2

Large-scale projects for which the Agency is the executing agency

Recipient country and title of the project	Start of field operations	Project duration (years)	Government contribution (in local currency)	UNDP contribution (in dollars)
ARGENTINA, National centre for non-destructive testing and quality control[a/]	23 March 1973	3.0	11 157 300 New Pesos	593 500
BRAZIL, Application of nuclear technology in agriculture	15 September 1972	5.0	12 433 310 Cruzeiro	899 000
CHILE, National nuclear energy centre	1974	3.5	46 900 000 Escudo	700 700
ARAB REPUBLIC OF EGYPT, Radiation dosimetry after accidents	30 November 1971	4.0	80 000 Egyptian Pounds	148 000
GREECE, Exploration for uranium in Central and Eastern Macedonia and Thrace[b/]	18 May 1971	4.5	31 256 000 Drachma	592 019

Recipient country and title of the project	Start of field operations	Project duration (years)	Government contribution (in local currency)	UNDP contribution (in dollars)
HUNGARY, Irradiation sterilization of medical products	1974	4.0	91 052 000 Forint	594 000
INDIA, Nuclear research in agriculture	14 October 1968	5.7	19 187 250 Rupee	1 665 600
INDIA, Demonstration plant for the irradiation sterilization of medical products	26 May 1972	3.0	4 552 500 Rupee	644 000
INDONESIA, Mutation breeding	1974	3.0	c/	108 400
REPUBLIC OF KOREA, Radiation processing demonstration facility	12 July 1973	3.0	340 360 000 Won	475 000
MOROCCO, Use of radioisotopes in agriculture	5 January 1974	3.0	930 000 Dirham	165 400
PAKISTAN, Detailed exploration of uranium and other radioactive occurrences in the Siwalik sandstones in the Dera Ghazi Khan District b/	27 September 1971	3.0	2 019 100 Rupee	660 300
ROMANIA, Development of nuclear technology	7 February 1973	3.0	119 985 500 Lei	1 242 200
TURKEY, Exploration for uranium in South-West Anatolia	1974	3.0	9 613 000 Lira	568 500
ZAMBIA, Radioisotope applications	1 October 1970	5.0	147 624 Kwacha	147 000

a/ Implemented in association with UNIDO.

b/ Implemented in association with the United Nations.

c/ Information not yet available.

National centre for non-destructive testing and quality control in Argentina[6] (Duration: 1973 to 1975)

31. Since 1973 non-destructive testing services have been provided to Argentine industries under this project. The work done by a group of Argentine specialists on non-destructive

[6] See document GC(XVII)/500, para. 40.

testing and quality control for industry is growing as more and more companies and industries become aware of the services which the centre is prepared to provide, including those of a competently staffed mobile laboratory.

Application of nuclear technology in agriculture in Brazil[7]
(Duration: 1972 to 1977)

32. This project was launched to help Brazil to establish facilities and acquire expertise in the application of nuclear techniques for research in agriculture. The main work will deal with plant breeding, including the production of crop varieties resistant to pests and diseases, plant nutrition and efficient practices in fertilizer management with special reference to hard beans, which constitute the main source of protein for human consumption in Brazil. The project, carried out at the Centre of Nuclear Energy in Agriculture in Piracicaba, is fully integrated into the National Bean Project.

National nuclear energy centre in Chile[8]
(Duration: 1974 to 1977)

33. The project has been developed to assist the Government of Chile in establishing a nuclear centre at La Reina, Santiago. The centre is equipped with a research reactor and laboratories for isotope production, as well as for research work in radiochemistry, medicine, engineering, physics and biophysics, and with associated equipment and facilities. Expert advice, fellowships and some equipment are being provided to train local staff and to introduce the use of nuclear techniques to deal with problems relating to nuclear engineering, agriculture, industry and medicine.

Radiation dosimetry after accidents in the Arab Republic of Egypt
(Duration: 1971 to 1975)

34. The main purpose of this project is to carry out laboratory investigations of the most reliable techniques for the assessment of radiation dose (from neutron and gamma rays) and of the concentration of radioactivity in air in case of radiation accidents.

Exploration for uranium in Central and Eastern Macedonia and Thrace, Greece[9]
(Duration: 1971 to 1975)

35. This project is intended to assist the Government in locating and defining areas of significant uranium potential. The results obtained have been encouraging and the project entered a second phase of two years' duration as from January 1974.

Irradiation sterilization of medical products in Hungary[10]
(Duration: 1974 to 1977)

36. This project provides for the establishment of a cobalt-60 irradiation facility at Debrecen for the sterilization of medical products. Equipment has been ordered and will be installed in 1976. The facility, which will be equipped with a 250 000-curie cobalt-60 source, will sterilize disposable syringes, surgical sutures and other medical supplies.

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[7] Ibid., para. 38.

[8] Ibid., para. 41.

[9] Ibid., para. 35.

[10] Ibid., para. 42.

Nuclear research in agriculture in India[11]
(Duration: 1968 to 1974)

37. A six-year project to strengthen nuclear research in agriculture in India has been completed. This project included the establishment of a nuclear research laboratory in the Indian Agricultural Research Institute in New Delhi and the provision of assistance to three other research institutes in India. Following scientific field trials, an industrial plant to produce radiation vaccines to combat the sheep lungworm in the Himalayan foothills is being constructed in Kashmir. Isotope studies of non-protein nitrogen feeds have resulted in the formulation of improved diets which have already been used successfully for feeding cattle. The project is being followed up on a considerable scale under the UNDP country programme for India.

Demonstration plant for the irradiation sterilization of medical products in India[12]
(Duration: 1972 to 1974)

38. The construction of the irradiation sterilization plant was completed in November 1973. Following the loading of a cobalt-60 source of 125 000 curies, the facility is being used by local medical suppliers to sterilize their products. Courses have been given to help manufacturers apply radiosterilization techniques to a wide range of products. It is expected that an additional cobalt-60 source will be installed during 1974 in order to meet the growing demand of irradiation services.

Mutation breeding in Indonesia
(Duration: 1974 to 1976)

39. The purpose of the project is to assist Indonesian scientists in improving economically important characteristics such as yield, disease resistance, earliness, fertilization responsiveness and nutritional quality of rice and other crops through mutagenic treatments.

Radiation processing demonstration facility in the Republic of Korea
(Duration: 1974 to 1976)

40. This project is to provide assistance to the Korean Atomic Energy Research Institute in Seoul in establishing a cobalt-60 irradiation facility and an electron beam processing system. The facility, loaded with 100 000 curies of cobalt-60, will be used for sterilization of medical supplies and wood-plastic combinations. The electron beam processing system will use a 300-keV accelerator for curing of surface coatings on panel boards. The project will assist the plywood industry, which plays an important part in the Korean industrialization programme, to develop new products. Construction work will begin in mid-1974 and the facility will be ready for service in late 1975.

Use of radioisotopes in agriculture in Morocco
(Duration: 1974 to 1976)

41. The aim of the project is to increase the yields of oil producing crops (mainly sunflower) as well as of sugar beet, wheat, cotton berseem and maize. This is essentially a continuation of an Agency technical assistance project; it started in January 1974 and will continue for three years. The Agency will provide "in service" training for Moroccan scientists, in addition to the fellowships envisaged under the project.

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[11] Ibid., para. 34.

[12] Ibid., para. 37.

Detailed exploration of uranium and other radioactive occurrences in the Siwalik sandstones in the Dera Ghazi Khan District in Pakistan[13]
(Duration: 1971 to 1974)

42. The Government is being assisted in determining the extent and the economic potential of uranium occurrences in the Siwalik sandstones. Findings have been sufficiently encouraging to justify an extension of the duration of field operations.

Development of nuclear technology in Romania[14]
(Duration: 1973 to 1976)

43. As indicated last year, the Institute of Nuclear Technology in Romania is being expanded so as to provide the basis on which national industry can play a significant role in the Romanian nuclear energy programme, in particular in the manufacture of some reactor components for nuclear power plants. The project, which was formally started in February 1973, has progressed satisfactorily. Expert services and fellowships are being provided by France, the Federal Republic of Germany, Italy and Sweden.

Exploration for uranium in South-West Anatolia, Turkey
(Duration: 1974 to 1976)

44. The objective of this project is to assist the Government in prospecting for and developing uranium resources within an area of Neagene sedimentary rocks in South-West Anatolia. An intensive search for hidden ore bodies and an economic evaluation of all ore bodies discovered will be made. The project started in April 1974 and will continue for three years.

Radioisotope applications in Zambia
(Duration: 1970 to 1975)

45. This project is an expansion of work begun under the Agency's regular programme (1969-1970) and UNDP (1970-1972) at the radioisotope unit of the National Council for Scientific Research. The main objective is the establishment of a radioisotope unit capable of assisting scientific investigations in a number of fields related to Zambia's development and training local staff in the use of radioisotope equipment.

The Agency's regular programme

46. The status of voluntary contributions to the General Fund for the years 1963-1973 and estimates for 1974 are shown in Table 3 below.

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[13] Ibid., para. 36.

[14] Ibid., para. 39.

Table 3

Voluntary contributions to the General Fund

Year	Established target (in millions of dollars)	Cash contributions pledged to the General Fund				
		Amount $	Percentage of target	Shortfall or (overrun) $	Number of Members pledging	Percentage of Members pledging
1963	2.0	1 437 394	71.9	562 606	40 of 85	47.1
1964	2.0	1 374 447	68.7	625 553	42 of 89	47.2
1965	2.0	1 330 590	66.5	669 410	55 of 94	58.5
1966	2.0	1 277 416	63.9	722 584	61 of 96	63.5
1967	2.0	1 431 823	71.6	568 177	62 of 98	63.3
1968	2.0	1 423 557	71.2	576 443	63 of 99	63.6
1969	2.0	1 488 426	74.4	511 574	68 of 102	66.7
1970	2.0	1 672 933	83.6	327 067	74 of 103	70.9
1971	2.5	2 151 375	86.1	348 625	72 of 102	70.6
1972	3.0	2 485 405	82.8	514 595	71 of 102	69.6
1973	3.0	2 841 756	94.7	158 244	65 of 104	62.5
1974[a/]	3.0	3 042 194	101.4	(42 194)	57 of 104	54.8

a/ As at 30 June 1974.

47. As shown in Table 4 below, the value of approved requests for experts and equipment under the Agency's regular programme decreased from $2 279 050 in 1973 to $2 262 700 in 1974.

Table 4

Experts and equipment: 1969-1974

Year	Value of requests received (in thousands of dollars)	Value of assistance approved (in thousands of dollars)	Percentage of requests met
1969	3700	977.0	26.4
1970	3400	1250.0	36.8
1971	3600	1891.0	52.5
1972	5268	2123.6	40.3
1973	5657	2279.0	40.3
1974	5849	2262.7	38.7

FOOD AND AGRICULTURE

48. The joint FAO/Agency programme is designed to assist developing Member States to apply isotopes and radiation techniques to the solution of food and agriculture problems. Special emphasis is placed on co-ordination and support of research. The current Co-ordinated Research Programmes, subsequently referred to in this report as CRPs are listed in Table 5 below.

Table 5

Research contracts and agreements on food and agriculture

CRP		Countries in which research is carried out with Agency support	Cost to the Agency in 1973 (in dollars)
1.	Use of isotopes in rice production studies	Bangladesh, Burma, India, Indonesia, Republic of Korea, Philippines, Sri Lanka, Thailand, Viet-Nam	16 000
2.	Fertilizer use for grain legumes	Brazil[a], Egypt, Ghana, Greece, Hungary, Peru, Romania, Senegal, Sri Lanka, United Kingdom[a], United States[a]	17 000
3.	Studies of soil-water regimes	Belgium[a], Brazil[a], Bulgaria, Chile, Cyprus, France (2[a]), Israel, Japan[a], Madagascar, Nigeria, Syrian Arab Republic, Thailand	23 450
4.	Micronutrient studies in rice production	Pakistan, Philippines, Thailand	9 000
5.	Seed protein improvement	Argentina, Australia[a], Austria[a], Bangladesh, Brazil[a], Chile, Cyprus, Denmark (2[a]), Egypt, Ethiopia, India (2), Jamaica, Japan[a], Republic of Korea, Nigeria[a], Pakistan, Sweden[a], Tanzania, Thailand, Uganda, Yugoslavia	[b]
6.	Induced mutations for disease resistance in crops	Argentina, Canada (2[a]), Czechoslovakia, Denmark[a], Egypt, Federal Republic of Germany[a], Hungary, India, Italy[a], Republic of Korea, Switzerland[a], United States (2[a]), Yugoslavia	37 380[c]
7.	Induced mutations in rice breeding and production	Egypt, Hungary, India (2), Indonesia, Republic of Korea, Pakistan, Sri Lanka, Thailand, Viet-Nam	20 000
8.	Improvement of mutation breeding techniques	Australia[a], Belgium[a], Czechoslovakia[a], France[a], India[a], Israel[a], Japan[a], Poland[a], United States (2[a])	-

CRP		Countries in which research is carried out with Agency support	Cost to the Agency in 1973 (in dollars)
9.	Improvement of vegetatively propagated crops	India, Israel, Japan (2), Philippines, Poland, United States[a]	15 000
10.	Studies on non-protein nitrogen in ruminants	Australia, Belgium[a], Czechoslovakia[a], Egypt, France[a], Federal Republic of Germany (2[a]), Hungary, India[a], Indonesia, United Kingdom[a], United States[a], Yugoslavia	13 400
11.	Animal parasitology and immunology	Kenya (2), Sudan	11 200
12.	Fruit-fly control by the sterile-male technique	Argentina, Cyprus, Egypt, Greece, Israel (2), Mexico, Peru, Philippines, Spain, Switzerland[a], Thailand, Venezuela, Yugoslavia	42 055
13.	Control of tsetse and other biting flies by the sterile-male technique	Belgium[a], Canada[a], Federal Republic of Germany[a], Israel[a], Kenya[a], Republic of Korea, United Kingdom[a]	2 500
14.	The Heliothis complex as related to the sterile-male technique	Argentina, Colombia, Mexico, United States (4[a]), Venezuela	7 500
15.	Control of Lepidoptera attacking fruit and forest trees	Czechoslovakia, Hungary (2), Poland, United States[a], Yugoslavia	13 500
16.	Isotopic tracer-aided studies of foreign chemical residues in food	Brazil, Canada[a], Federal Republic of Germany (2[a]), Ghana, India, Italy, Lebanon, Netherlands, Pakistan, United Kingdom[a], Venezuela[a]	21 300[c]
17.	Isotopic tracer-aided studies of foreign chemical residues in the agricultural environment	Canada[a], Finland, Federal Republic of Germany[a], India, Israel, Japan[a], Philippines, Turkey, Uganda, United States[a], Yugoslavia[a]	32 750[c]
18.	Biological side-effects of foreign chemical residues in food and agriculture	Austria (2[a]), Hungary, Israel, Netherlands[a], United Kingdom[a], United States[a]	5 400

CRP		Countries in which research is carried out with Agency support	Cost to the Agency in 1973 (in dollars)
19.	Shelf-life extension of irradiated fruit and vegetables	India, Netherlands, Nigeria, Philippines, United Kingdom[a/]	13 235
20.	Preservation of fishery products by irradiation	Bangladesh, Belgium, Indonesia, Pakistan, Thailand (2)	19 000

a/ Cost-free research agreement.

b/ The total costs of this CRP, of the order of $103 500, are borne by the Radiation and Environmental Research Organization of the Federal Republic of Germany under a co-operative agreement.

c/ Partly funded by SIDA.

49. Large amounts of energy are used to produce nitrogen fertilizers and recent developments in energy costs have an obvious impact on the production and use of nitrogen fertilizers, especially in the developing countries. Of particular interest in these circumstances are the results of research just completed under the joint FAO/Agency programme in which isotopes and radiation were employed to study the most efficient use of nitrogen fertilizers in wheat farming. Briefly, the study showed that:

(a) Split applications of nitrogen fertilizer produce both higher yield and higher protein content than a single application of the same aggregate amount at planting time;

(b) The various chemical forms of nitrogen fertilizer - ammonium nitrate, urea and ammonium sulphate - were found to be remarkably similar in their effectiveness; and

(c) Application of starter amounts of nitrogen with the seed had much the same effect on nitrogen uptake and yield as the often more expensive operation of side-band application (the application of fertilizers as a band alongside a row of seeds) of the same amount of fertilizer.

50. Up to now, FAO/Agency research in this field has been confined to the major plant nutrients nitrogen and phosphorus [15]. However, with the introduction of high-yield rice varieties, the increasing use of highly refined inorganic fertilizers which supply only the major plant nutrients and the long periods of monoculture in rice fields, deficiencies of certain micronutrients, particularly zinc, begin to appear. Therefore, a new research programme has been started to study various aspects of this problem [16].

[15] See Table 5 above, CRPs 1 and 2.

[16] Ibid., CRP 4.

51. As a result of research done under the joint FAO/Agency programme, four improved mutant varieties of rice are now being grown in Bangladesh and the Philippines, and one is about to be released to farmers in Hungary. Remarkable increases in the lysine content of barley have been reported by a collaborator in Denmark following mutation induction in seeds.

52. A new programme has been started to study the effect on various livestock of the parasites of bilharzia (schistosomiasis), sleeping sickness (trypanosomiasis), East Coast Fever and other gastro-intestinal parasites. Isotope-aided studies on ruminants have shown that there are marked differences between the effects of various diets, particularly those involving tubers of tropical origin, on the efficient utilization of non-protein nitrogen. This is a matter of practical importance in feeding livestock since it is more economical to substitute non-protein nitrogen sources (such as urea) for true protein and, in addition, true protein can be used in many cases directly for human consumption.

53. The sterile-male technique has been successfully tested for controlling the Mediterranean fruit fly in Cyprus, Israel, Italy, Peru and Spain. Work on the olive fly, codling moth and particularly the tsetse fly is progressing rapidly. The technique itself, based on radiation sterilization of artificially reared colonies followed by their release, is now becoming one of an array of pest management techniques rather than an isolated method. This wider approach depends on a better knowledge of insect behaviour and ecology, for the study of which radioisotopes are a useful tool [17]. A new research programme has now been approved, its purpose being to study the use of isotopes, in addition to radiation, as a means of solving specific problems of pest management.

54. Research work on chemical residues and pollution has been expanded to include tracer-aided studies of the biological side-effects of foreign chemical residues in food and agriculture and on agricultural nitrogen residues in relation to their role as potential pollutants. This work has provided valuable information on the behaviour of various residues such as those of toxic metals, pesticides and polychlorinated biphenyls, in food, agriculture and fisheries.

55. As shown in Figure 5 below, 17 countries now permit the restricted, or in some cases, the unrestricted sale of 19 items of irradiated food. Twenty-two Member States participate in the International Project in the Field of Food Irradiation at Karlsruhe, Federal Republic of Germany.[18] In 1969, temporary international acceptance of irradiated wheat, wheat products and potatoes was recommended by a Joint FAO/IAEA/WHO Expert Committee on Wholesomeness of Irradiated Foods. At the same time, it was indicated that additional data would be required before such acceptance could be made unconditional and the deadline for submitting them was set for 1974. These data will shortly become available from the above International Project and the final decision will obviously be of great importance to the future of food irradiation.

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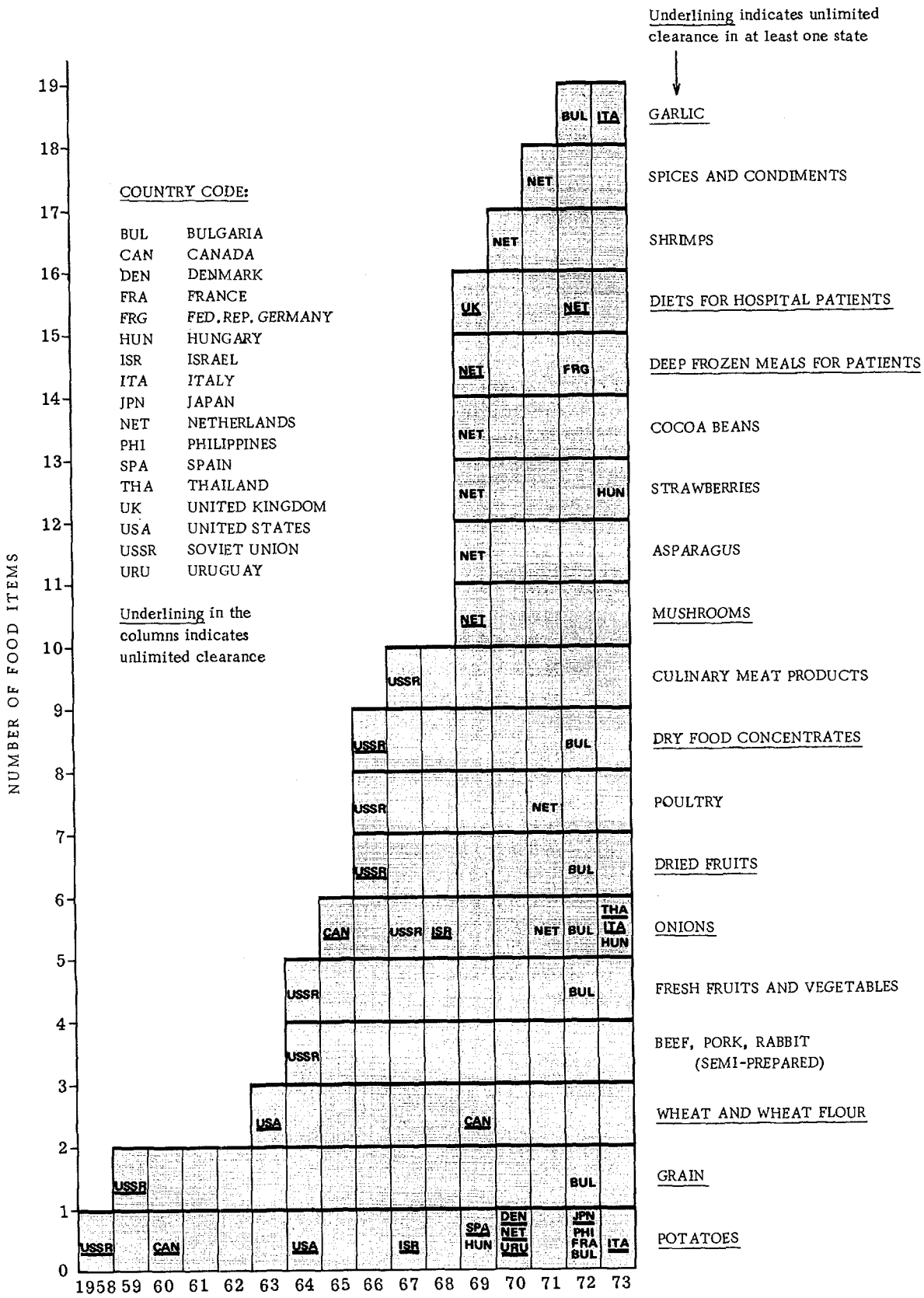
[17] Ibid., CRPs 12 to 15.

[18] See document GC(XVI)/480, para. 36(c).

FIGURE 5

IRRADIATED FOODS CLEARED IN ONE OR MORE COUNTRIES
AS OF DECEMBER 1973
(with dates of first clearances)



56. In the meantime, the Agency has sponsored co-operation between laboratories in ten countries for work on the technical feasibility of fish irradiation under an Asian regional project.

57. Other work done during the period covered by this report included four panels at the Agency's Headquarters as well as a working group in Manila to launch the Asian regional project referred to in paragraph 56. In August 1973, the Agency, together with FAO and WHO, convened a symposium in Helsinki to review the use of nuclear techniques for studying problems of chemical and radioactive contamination of food, of the environment and of organisms. The symposium showed that it is essential to take into account the complex nature of environmental contamination and the possible synergetic action of two or more contaminants on organisms.

58. A symposium on isotope and radiation techniques in studies of soil physics, irrigation and drainage in relation to crop production, was held in Vienna in October 1973. The purpose of this symposium was to discuss the most recent developments in the use of isotope and radiation techniques to study the physical properties of soils and their effect on the relationship between plants and water.

LIFE SCIENCES

59. This programme consists, as in the past, of work on medical applications of radioisotopes, radiation biology and radiation dosimetry. It continues to focus chiefly on the needs of the developing countries. Certain routine medical applications are being transferred to WHO.

Medical applications

60. New medical uses of radioisotopes, new radiopharmaceuticals and new nuclear instruments continue to enlarge the scope and promote the growth of nuclear medicine, and thereby stimulate requests for assistance from Member States. Some uses have now become routine in many hospitals, and the Agency is continuing its policy of transferring international responsibility for such routine techniques to WHO.

61. During the period covered by this report, the programme has concentrated on the use of nuclear techniques in:

(a) Studies of human nutrition. The joint research programme with WHO on iron metabolism [19], which aimed at studying the availability and utilization of iron in food, is nearing completion. It has produced significant results relating to iron nutrition under various staple diets and to measures that can be useful in improving such nutrition and preventing anaemias caused by iron deficiency;

(b) Activation analysis. This technique is being used in CRP 2 in Table 6 below, which includes a joint research programme with WHO on trace elements in cardiovascular diseases aimed at studying the possible role of trace elements in the aetiology of such diseases;

(c) Microbial immunology. Under this activity particular attention is devoted to applications of radioisotopes in the study of immunity against communicable diseases such as cholera, and to the development of simple techniques of testing for immunity which can be of value in the control of outbreaks of such diseases;[20]

(d) Functional studies in clinical medicine and research. This work relates to applications of radioisotopes in the study of the functional state of body organs and tissues, and has been particularly concerned with studies of the cardiovascular system;[21]

(e) In vitro procedures in clinical medicine and research. Under this programme [22] the Agency is helping Member States to introduce radio-immunoassay and related techniques to measure various hormones, notably those of small molecular size which may be difficult to determine by other means, and also to measure antigens associated with tumours and viruses. These techniques find many applications in clinical medicine as well as in research; and

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[19] See Table 6 below, CRP 1.

[20] Ibid., CRP 4.

[21] Ibid., CRP 6.

[22] Ibid., CRP 3.

(f) Scintigraphy. The delineation of organs or tissues of the body and the detection of lesions within them as based on the distribution of radioisotopes in these organs or tissues, is an important tool in clinical medicine, for instance in cancer diagnosis. Under the relevant research programme [23] techniques for data processing in scintigraphy have been compared and studies are being made of alternative techniques for displaying the processed data.

62. The current CRPs are listed in Table 6 below.

Table 6

Research contracts on radioisotope applications in medicine

CRP		Countries in which research is carried out with Agency support	Cost to the Agency in 1973 (in dollars)
1.	Studies or iron metabolism	Bangladesh, Cuba, India, Jamaica, Romania[a/], South Africa, Sri Lanka, Sudan, Sweden[a/], United States[b/]	16 510
2.	Radioactivation techniques in studies of trace elements and mineral metabolism in man	Argentina, Bulgaria, Federal Republic of Germany[a/], Greece[a/], Turkey, United Kingdom (2[a/]), United States[a/]	5 500
3.	In vitro assay techniques and their applications	Argentina, Austria[a/], Bulgaria, Chile (2), Czechoslovakia, Ecuador (2), Greece (2), Iran Iraq, Nigeria (2), Peru, Romania, Turkey, Zambia	54 300
4.	Immunological studies of communicable diseases	India, Jamaica, Kenya, Peru, Sudan, United States, Yugoslavia	30 000
5.	Scintigraphy	Belgium[a/], Ecuador, Federal Republic of Germany (2[a/]), Japan[a/], Poland[a/], Spain[a/], Sweden (2[a/]), United Kingdom (3[a/]), United States (5[a/]), Uruguay	-
6.	Cardiovascular studies	Argentina, Israel, Sudan	10 500

a/ Cost-free research agreement.

b/ Technical contract.

[23] Ibid., CRP 5.

63. All the CRPs were started in 1969 and some are now undergoing changes of emphasis as indicated above. The following activities were also undertaken during the period under review:

(a) A symposium on radioimmunoassay and related procedures in clinical medicine and research. This was held in Istanbul, Turkey, in September 1973 and participants presented reports on new techniques to measure hormones involved in human reproduction, hormones of small molecular size and antigens associated with tumours and viruses;[24] and

(b) A meeting on the diagnostic applications of radioisotopes in haematology in Leiden, Netherlands, in November 1973. The meeting discussed techniques to study mechanisms of destruction of red blood cells, to determine circulating blood volume and to measure the survival time of blood platelets.

Radiation biology

64. The Agency continues to promote practical applications of radiation biology of interest to developing countries, such as the sterilization of medical and pharmaceutical products, the development of mutant micro-organisms producing substances of nutritional and pharmacological value, and the use of radiation techniques in preparing vaccines. At the same time, the Agency is giving more attention to the genetic and somatic effects of radiation on man, a question of fundamental importance for the long-term future of nuclear power. The transfer of UNSCEAR to Vienna early in 1974 is expected to lead to closer co-operation with that Committee.

65. The current CRPs are listed in Table 7 below.

Table 7

Research contracts on radiation biology

CRP		Countries in which research is carried out with Agency support	Cost to the Agency in 1973 (in dollars)
1.	Sterilization of medical products and biological tissues	Czechoslovakia (2), Denmark (1+1[a]), Greece, Hungary, Poland, United Kingdom [a]	15 000
2.	Radiation microbiology	Austria (2+1[a]), Bulgaria, Czechoslovakia, France (2[a]), Greece, Malaysia, Nigeria, Pakistan, Philippines, Singapore, United Kingdom	34 500
3.	Use of nuclear techniques in the preparation of vaccines against parasitic diseases	Argentina, Belgium, Canada[a], Ethiopia, Federal Republic of Germany[a], India, Iraq, Portugal, United Kingdom (3[a]), United States (2[a])	17 500
4.	Radiation biology of neutrons and heavy particles	Argentina, Austria, Netherlands	9 000

[24] See Table 6 above, CRP 3.

CRP		Countries in which research is carried out with Agency support	Cost to the Agency in 1973 (in dollars)
5.	Chemical modification of radiosensitivity	India, Republic of Korea, Turkey	7 500
6.	Environmental radiation biology	Austria, Chile, Poland	7 500

a/ Cost-free research agreement.

66. In connection with CRP 1 in Table 7 above, the Agency has worked on:

(a) A manual on radiation sterilization of medical and biological materials. The manual is meant to assist Member States that have recently installed radiation plants (e.g. Czechoslovakia, Greece, India, Poland and Spain) or plan to install them in the near future; and

(b) A revision of the recommended code of practice for radiation sterilization of medical products, originally published in 1967.

One of the most significant results of CRP 2 in Table 7 above, has been the development of a better yeast mutant which produces methionin. When this is applied to cassava starch - the staple cereal used for making bread in many Central American countries - the resulting product contains much larger quantities of nutritional protein. Research has also yielded mutants of a fungus (Aspergillus) which efficiently produce amylase, extensively used in food and pharmaceutical industries.

67. In the period covered by this report, the Agency held the following meetings in radiation biology:

(a) A symposium on the effects of neutron irradiation upon cell function in Neuherberg, Federal Republic of Germany, to survey the progress made in neutron radiation biology since the previous symposium on the same subject convened by the Agency in New York in October 1963; and

(b) A panel, arranged jointly with WHO, at Nairobi in November 1973, on the use of nuclear techniques for research into and control of helminthic infections.

Dosimetry

68. The postal dose intercomparison service, which the Agency is providing in co-operation with WHO, to hospitals and radiotherapy centres in Member States has now entered its seventh year.[25] This service enables them to check doses and dose rates and thereby to perform radiation therapy on cancer patients with much greater precision than would otherwise be possible.

69. An evaluation of the results obtained since 1968 shows that there has been a considerable improvement in accuracy. The number of institutes taking part in the service whose results display a deviation of 10% or more from the Agency standard is now much smaller than in 1968.

[25] See also document GC(XVII)/500, para. 58.

70. Since any deviation of more than 10% from the intended dose will decrease the efficiency of the treatment and might even cause harmful effects, the results demonstrate the value of the service.

71. To increase the effectiveness of this endeavour and to reduce costs, the Agency and WHO are promoting the establishment and designation of secondary standards dosimetry laboratories; the six laboratories which already had been designated were joined in 1973 by the dosimetry laboratory of the Companhia Brasileira de Technologia Nuclear in Rio de Janeiro which has organized a postal dose intercomparison service.

72. A panel held in Vienna in October 1973 formulated recommendations on the use of computers in planning radiation therapy treatment; Austria, Bulgaria and Hungary have already adopted suitable computer programmes for local use within the framework of a CRP. The Agency distributed about 40 californium-252 needles, donated by the United States, to universities in eight countries and is preparing a manual on the use of such sources in training purposes.

73. CRPs on radiation dosimetry are being supported by the Agency under 25 contracts and are listed in Table 8 below.

Table 8

Research contracts on dosimetry

CRP		Countries in which research is conducted with Agency support	Cost to the Agency in 1973 (in dollars)
1.	Biophysical aspects of radiation quality	United Kingdom[a/], Yugoslavia[a/]	-
2.	Computer application in clinical dosimetry	Austria[a/], Bulgaria[a/], Canada[a/], Hungary[a/], Iran, Israel, Italy[a/], Mexico[a/], Romania[a/], Sweden[a/], Switzerland, United States (2[a/])	5 500
3.	Development of a transfer instrument for neutron dosimetry intercomparison	France[a/], Federal Republic of Germany, Netherlands[a/], United Kingdom, United States (4[a/])	1 440

a/ Cost-free research agreement.

74. Two further contracts relating to the dosimetry of ionizing radiation by chemical methods have been awarded to institutes in Denmark and Yugoslavia. The cost to the Agency amounted to $7450 in 1973.

PHYSICAL SCIENCES AND LABORATORIES

General

75. The programmes dealing with nuclear science applications in industry and hydrology are of special interest to the developing countries and have been stepped up. The Agency continues to follow and help co-ordinate research on controlled nuclear fusion through the work of its International Fusion Research Council. During the period covered by this report, the Agency supported workshops on fusion reactor technology and on laser- and electron-beam-induced fusion. The volume of nuclear data handled is steadily expanding currently at about 50% a year.

76. The Italian Government will increase its financial support for the International Centre for Theoretical Physics at Trieste from $250 000 to $350 000 per annum from 1 July 1974, on the understanding that the Agency and UNESCO each increase their contributions to $200 000 per annum.

77. The International Laboratory of Marine Radioactivity in Monaco is expanding its activities with funds from UNEP to include research on non-radioactive pollution of the ocean. The agreement with the Monagesque Government and the Oceanographic Institute will expire at the end of 1974 and negotiations to renew it for a further six-year period are in progress.

78. The Seibersdorf Laboratory is discontinuing the distribution of standardized radioactive sources since this service is now being provided adequately by national institutions or commercial firms.

Physics

79. The main objective of this programme is to encourage the exchange of information on new developments in physics research. During the period covered by this report it included the following meetings:

(a) The third symposium on the physics and chemistry of fission, at Rochester, United States, in August 1973. This meeting showed that significant progress, particularly in the development of the theory of the basic fission process, has been made since the second symposium held in 1969;

(b) An expert meeting to compare nuclear techniques used in solid-state spectroscopy (Vienna, November 1973); and

(c) A meeting to co-ordinate research on the use of charged-particle-induced X-ray fluorescence in elemental trace analysis (Vienna, December 1973). This technique, which makes use of low-energy accelerators of the type which is fairly common in developing as well as industrial countries, was shown to have important uses in studies of pollution and other environmental questions.

80. The current CRPs are listed in Table 9 below.

Table 9

Research contracts and agreements on physics

CRP		Countries in which research is carried out with Agency support	Cost to the Agency in 1973 (in dollars)
1.	Nuclear physics: fission, neutron capture	Israel, Poland, Yugoslavia	6000
2.	Neutron scattering for solid-state studies	Netherlands, Poland	8700
3.	Charged-particle-induced X-ray fluorescence for trace analysis	Belgium[a/], Romania, South Africa[a/], Sweden[a/], Yugoslavia	6000

a/ Cost-free research agreement.

81. Three further contracts on Mössbauer effect studies have been awarded to institutes in Bulgaria, Greece and Israel. The cost to the Agency amounted to $2500 in 1973.

82. The Agency issued in 1973 a revision of its "World Survey of Major Facilities in Controlled Fusion Research" originally published in 1970. The International Fusion Research Council held meetings in Moscow in July 1973 and in Vienna in May 1974. A workshop on the problems of fusion reactor technology was held in Culham, United Kingdom, in January/February 1974.

83. A meeting of the Joint NEA/IAEA International Liaison Group on thermionic electrical power generation was held in Paris in May 1974.

Industrial applications and chemistry

84. The current CRPs are listed in Table 10 below.

Table 10

Research contracts and agreements on industrial applications and chemistry

CRP		Countries in which research is carried out with Agency support	Cost to the Agency in 1973 (in dollars)
1.	Nuclear methods for trace elements analysis	India, Indonesia, Republic of Korea, Philippines, Thailand	15 000
2.	Nuclear techniques in geology and mineral prospecting	Czechoslovakia, Indonesia, Romania	6 000
3.	Preparation and quality control of radiopharmaceuticals	Colombia, Czechoslovakia, India, Romania, Uruguay	19 000
4.	Rapid methods for the quality control of radiopharmaceuticals	Brazil, India	7 000

85. It will be seen that the research is oriented chiefly towards questions of interest to developing countries - prospecting for minerals and production of radiopharmaceuticals. For this latter purpose, radioisotopes and radiation sources are now becoming available in several developing countries to supplement those obtained from producers in more advanced countries.

86. With regard to trace elements analysis, the Agency is encouraging laboratories in developing countries to avoid excessive dependence on any single analytical technique. It convened a panel in August 1973 to provide guidance on the practical problems of activation analysis.

87. In relation to CRPs 3 and 4 in Table 10 above, the Agency is trying to help Member States to overcome import and distribution problems which reduce the availability or quality of radioisotopes and radiopharmaceuticals.

88. The Agency also held a training course in tracer techniques used for industrial and environmental pollution studies at North Carolina State University, United States, in July 1973, and convened a study group meeting on radiation engineering in the academic curriculum in Haifa, Israel, in August 1973. A meeting on the theory of hot atom reactions was held in Vienna in May 1974.

Isotope hydrology

89. Information exchange and training continue to be the mainstay of the Agency's programme in isotope hydrology.

90. A regional seminar for Latin America was held in Mexico City in November 1973 on the use of isotope techniques in planning and development of water resources and in drawing up water resource inventories. The Agency also provided lecturers on isotope hydrology for training courses in Austria, Czechoslovakia, the Federal Republic of Germany, India and Italy. A symposium on isotope techniques in ground-water hydrology was held in Vienna in March 1974.

91. The Agency gave expert advice to Greece, Mexico, Tanzania and Turkey for their isotope hydrology programmes and the Laboratory provided analytical services for projects in Afghanistan, Austria, Bolivia, Poland, Tanzania and Turkey. The Agency also advised other United Nations organizations about the use of nuclear techniques in their water resource projects, for example in Bolivia, Mali, Mauritania, Qatar, Spain (Canary Islands) and Togo.

92. The current programme of support for work in isotope hydrology provides for research under 13 contracts in the following countries: Brazil, Chile, Cyprus, Egypt, France, Hungary, Iceland, Indonesia, Israel, Netherlands, Poland, South Africa and Turkey. The cost to the Agency for these contracts amounted to $40 500 in 1973.

Nuclear data

93. The main activities of the Agency in this area, carried out in co-operation with the neutron data centres at Brookhaven, Oak Ridge, Obninsk and Saclay/NEA continue to be the annual publication of CINDA, the reference handbook for neutron data, and the compilation, exchange and dissemination of experimental neutron data. A handbook has also been published containing nuclear data for activation analysis.

94. Figures 6 and 7 below illustrate the increase in the number of CINDA reference entries between 1970 and 1973, and in the number of sets of experimental neutron data exchanged between the above-mentioned centres during the same period.

FIGURE 6

NUMBER OF ENTRIES IN CINDA HANDBOOK

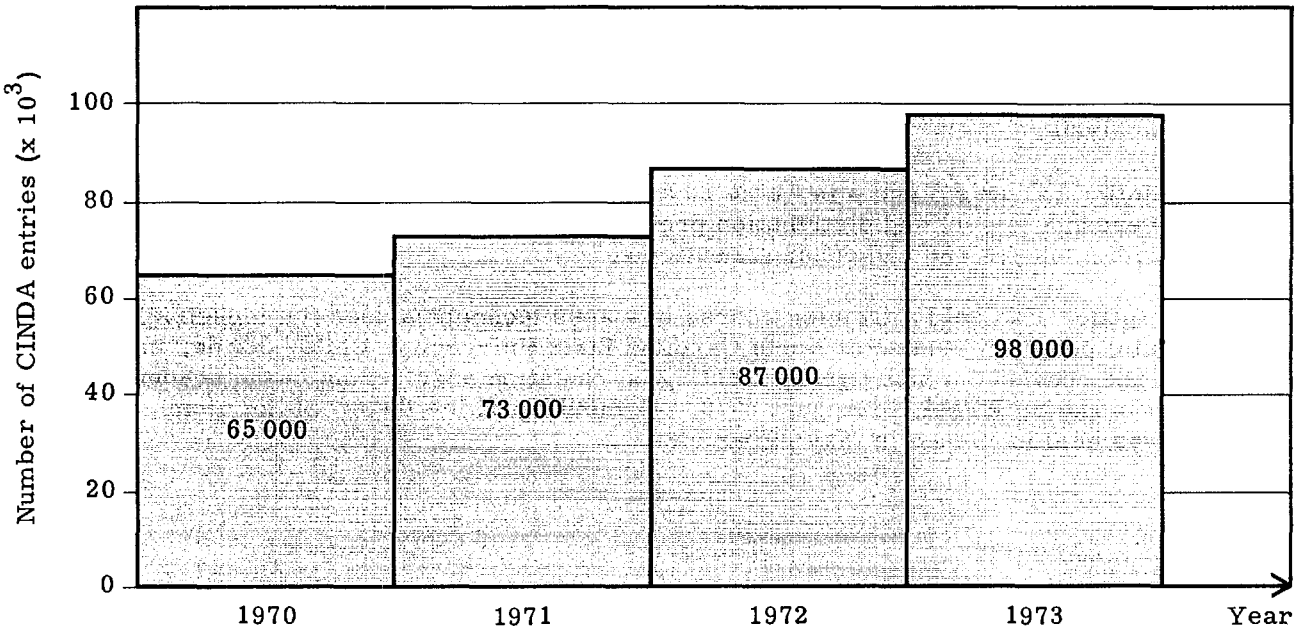
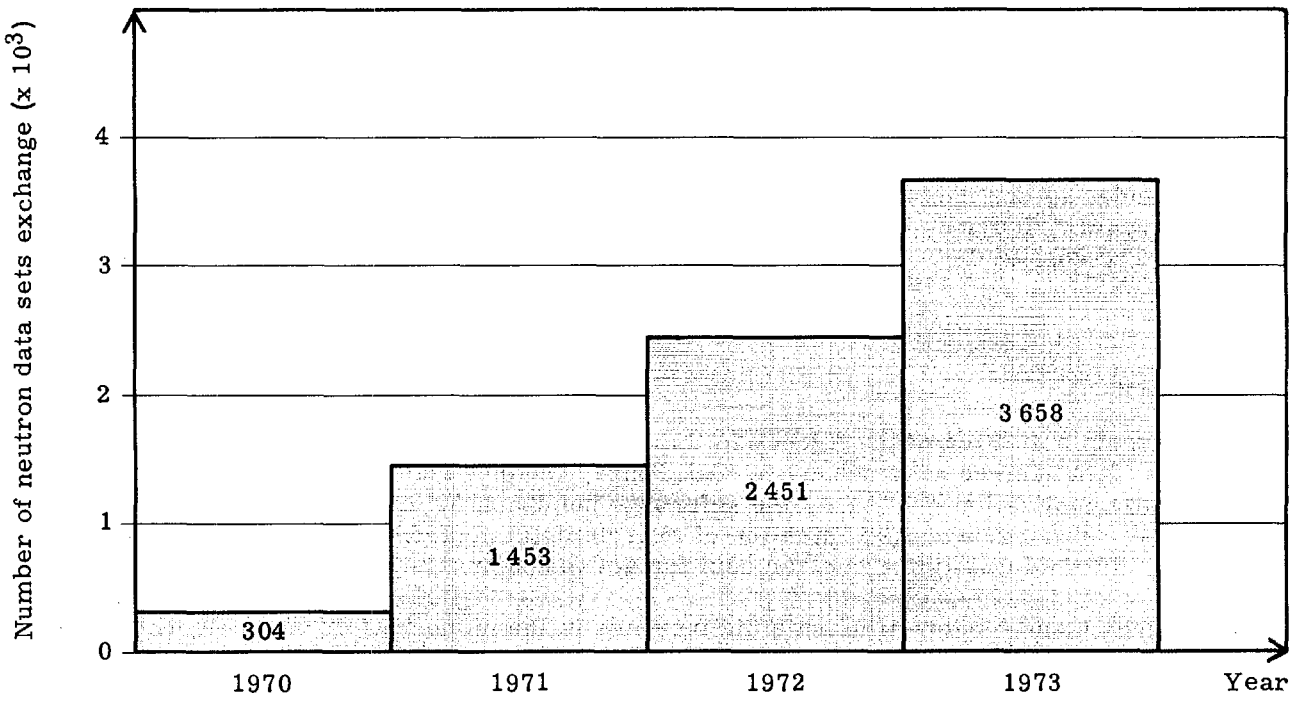


FIGURE 7

NUMBER OF SETS OF EXPERIMENTAL NEUTRON DATA EXCHANGED



95. Furthermore, the Agency has also begun to co-ordinate the compilation, evaluation and exchange of non-neutron nuclear data.

96. To help assess the need for nuclear data, the Agency held a panel on fission product nuclear data at Bologna, Italy, in November 1973. This matter is receiving increasing attention because of its importance for reactor safety and the panel provided the first comprehensive review of the subject.

Laboratories

Seibersdorf Laboratory

97. The number of analyses of samples taken for safeguards purposes is expected to increase from 250 in 1973 to about 1000 in 1974. To assist in such analyses, the Laboratory has installed a new mass spectrometer with computer data readout. It has also continued work in designing and manufacturing safeguards surveillance equipment.

98. In relation to the co-ordinated research programme on seed protein improvement [26] the Laboratory has developed mass-screening methods for determining protein and amino-acid content of mutation samples of grains.

99. In regard to the sterile-insect release technique it has continued to develop techniques for the mass-rearing of tsetse flies, Mediterranean fruit flies and olive flies in support of CRPs 12 to 15 in Table 5 above.

100. The Laboratory has provided "in service" training for fellows from Indonesia, Pakistan, Romania and the Syrian Arab Republic.

International Laboratory of Marine Radioactivity in Monaco

101. The co-ordinating work done by the Laboratory revealed that considerable differences remain in the capability of co-operating laboratories in Member States accurately to measure important fission product radionuclides, such as ruthenium-106. The main problem seems to be insufficient care in the standardization of procedures. For its next intercalibration exercise, the Laboratory has distributed large volume samples of "open ocean" Atlantic water of low radioactivity. It is carrying out tests to show the homogeneity of biological samples which have been labelled with activation products.

102. The Laboratory is now able to carry out analysis by:

(a) Alpha spectrometry;

(b) Sensitive atomic absorption spectrometry for trace metal determinations;

(c) High-resolution gamma spectrometry; and

(d) Gas chromatography for analysis of pesticide residues and for measuring dissolved organic carbon in sea-water.

103. Under the expanded programme [27], preparations are being made for analytical studies of heavy metals and chlorinated hydrocarbons (DDT, polychlorinated biphenyls). The work will be similar to that which the Laboratory is currently carrying out, in the sense that its main objective will be to assist co-operating laboratories in Member States

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[26] See CRP 5 in Table 5 above.

[27] See also para. 75 above.

to compare the results of their analyses and thereby to improve their analytical techniques and procedures. The Monaco Laboratory will also itself analyse certain trace metals and radionuclides, as well as pesticides contained in samples taken from the Mediterranean.

International Centre for Theoretical Physics at Trieste

104. The Centre's major activities of interest to the Agency included extended courses on nuclear physics as well as "research workshops" in solid-state physics, plasma physics, and astrophysics and the theory of relativity. It carried on theoretical research in high-energy physics throughout the year. Under an agreement with the Federal Republic of Germany, promising young scientists from the developing countries, associated with the Centre, will be invited to visit the Max-Planck-Institut für Kernphysik at Heidelberg or the Max-Planck-Institut für Festkörperforschung at Stuttgart, at the Government's expense, for periods of up to three months.

105. Negotiations have begun with UNESCO regarding an extension of the agreement on joint operation of the International Centre for Theoretical Physics, which is to expire at the end of 1974.

106. SIDA has continued to provide funds in support of the Centre's associate membership scheme. UNDP has likewise continued to support the Centre's activities, and funds were also made available by the Ford Foundation until the end of 1973.

NUCLEAR POWER TECHNOLOGY AND ECONOMICS

General

107. Increasing prices of fossil fuel and the oil situation contributed to the record high-level of orders in 1973 for nuclear plants, namely 59 984 MW. As shown in the table below the total installed nuclear generating capacity had reached 45 250 MW by the end of 1973. In some countries licensing requirements have considerably delayed nuclear power projects, but on the basis of present orders, it is still expected that the nuclear generating capacity will reach 104 000 MW by 1975 and more than 300 000 MW by 1980. Estimates for the longer term suggest, more tentatively, that by 1990 the aggregate nuclear capacity will be 1 300 000 MW and by the year 2000, 3 500 000 MW but present realignments in the energy market will probably indicate higher estimates in the near future.

Table 11

Forecast of installed total electric and nuclear capacity
(in thousands of MW)

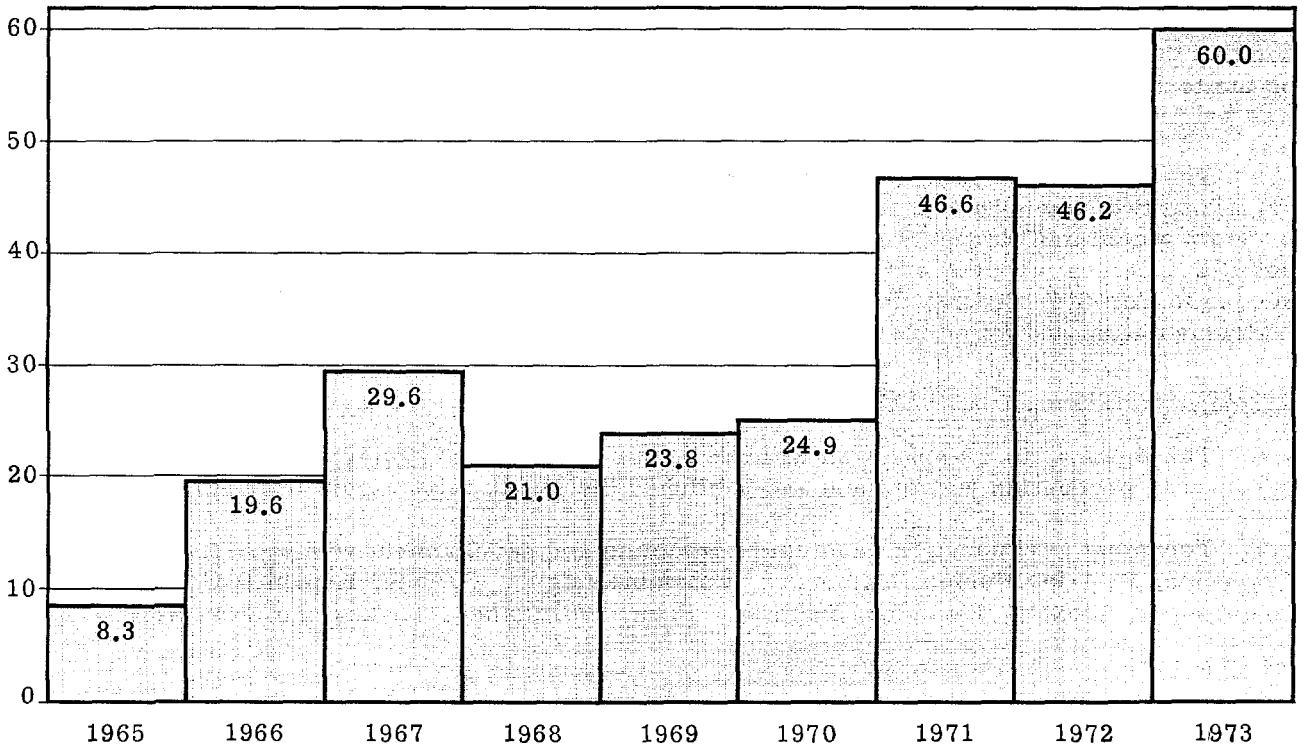
	1973	1975	1980	1985	1990	2000
Electrical	1360	1600	2300	3200	4500	8900
Nuclear	45.250	104	302-316[a]/	700-890[a]/	1400-1900[a]/	3600-5300[a]/
Percentage share of nuclear (%)	3.3	6.5	13-14	22-28	31-42	40-60

a/ The higher figure refers to the assumption of an accelerated nuclear programme, due to the energy situation.

108. Past trends in annual orders of nuclear power plant are evident from Figure 8 below.

FIGURE 8

NUCLEAR POWER PLANT ORDERS BY YEAR
(in thousands of MW)



109. The capital costs of nuclear power plants remained fairly stable during 1973 and the relationship between these costs and those of fossil-fired plants has also remained constant. It is probable that capital costs for both types of plant will increase in the near future, but it is still too early to discern clear trends.

110. The increase in oil prices has been so sharp that generation of electricity by nuclear power plants has become competitive in all locations where use of imported oil would be the only alternative, and in sizes for which nuclear plants are offered commercially, i.e. above 500-600 MW.

111. As a result, many countries are revising their nuclear power programmes as was made evident in the course of a study group meeting on reactor strategy calculations held in November 1973 in Vienna.

Power reactors

112. The results of the market survey for nuclear power in developing countries, which was completed in 1973, are being updated to take into account the sharp increase in imported oil prices. An extension using simplified methodologies has also been made to include all developing countries. The updating and extension clearly show not only an increase from 110 000 MW to 170 000 MW in the market for nuclear power stations which are now commercially available, but also a great increase in the potential market for small and medium power reactors (i.e. 150-400 MW). With reasonable assumptions about capital costs for these plants, an additional 40 000 MW could be installed in the developing countries during the period 1980-1990. There remains however the problem that plants in this size range are not commercially available.

113. The methodologies used for the market survey for nuclear power in developing countries have been further developed and applied to nuclear power planning studies requested by Iran. While the nuclear power market survey inevitably had to make certain broad assumptions about all the countries covered, these nuclear power planning studies have taken local conditions in each country more carefully into account and should be much more useful for the system expansion and nuclear power programme planning in each individual country.

114. It will be recalled that the Agency served as executing agency for a UNDP financed feasibility study in the Philippines[28]. Upon its completion, the Philippine Government decided to build a nuclear power station. A survey and briefing course financed by UNDP on the technical and economic aspects of nuclear power development in the ECAFE region was held by the Agency in Bangkok in December 1973.

115. The Agency's working group on nuclear power plant control and instrumentation organized two specialists' meetings related to reliability and safety of reactor operation. A meeting held in Cologne, Federal Republic of Germany, in October 1973 considered both the technical aspects and the safety functions of reactor protection systems and the second in Toronto, Canada, in May 1974 was directed towards problems of in-core instrumentation and failed fuel element detection and location.

Nuclear materials and fuel cycle

116. The Agency, in co-operation with NEA, has continued to review world uranium resources, production and demand and published the fourth joint report in August 1973.

117. Technical assistance in uranium prospecting and development was provided to Argentina, Bolivia, Burma, Cameroon, Colombia, Egypt, Greece, Republic of Korea, Madagascar, Mexico, Morocco, Pakistan, Peru, Philippines, Turkey and Uruguay.

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[28] See document GC(XVII)/500, para. 32.

118. The Agency held a panel on radon in uranium mining: the effect of protective controls on uranium reserves and costs, ventilation problems and basic research in Washington in September 1973, and a symposium in Athens in May 1974 on the formation of uranium ore deposits.

119. The co-ordinated research programme on the bacterial leaching of uranium ores is being continued with eight institutes from different countries.

120. Several projects concerning the methods of production and testing of nuclear fuel materials are being implemented in Argentina, Brazil, Republic of Korea, Mexico and Poland.

Supply of nuclear materials

121. Requests for the supply of nuclear materials approved by the Board, and materials supplied under the authority delegated to the Director General by the Board in September 1968, are listed in the following Table 12.

Table 12

Supply of nuclear materials

Receiving State/ organization	Purpose	Quantity and type of fissile material	Approximate enrichment (when applicable)
IAEA	PAFEX-1 research	29 Pu-U oxide pellets, 14 Pu oxide and 28 Pu nitrate samples[a/]	
IAEA	Calibration of IAEA safeguards instruments	7 natural U samples[a/]	
IAEA	Nuclear data measurements	30 mg ^{233}U, 98 g ^{235}U, 129 g ^{238}U, 12 mg ^{239}Pu, 10 mg ^{241}Pu, 10 mg ^{241}Am, 5 mg ^{243}Am and 30 mg ^{237}Np[a/]	
IAEA	Quality control	2 g U_3O_8 and 260 g U metal[a/]	
IAEA	PAFEX-2 research	200 mg ^{233}U and 2 mg ^{242}Pu[a/]	
IAEA	Calibration of IAEA-NPT safeguards instruments	31 g ^{235}U in U/Al alloy standards[a/]	
IAEA	For use at Monaco Laboratory	0.5 µCi ^{236}Pu and 5-10 µCi ^{237}Pu samples[a/]	
IAEA	Nuclear data measurements	80 mg ^{238}U and 80 mg ^{239}Pu[a/]	

Receiving State/ organization	Purpose	Quantity and type of fissile material	Approximate enrichment (when applicable)
India	Spectrochemical analysis	27 g ^{235}U in 4 samples[a/]	49-93%
India	Instrument calibration and analysis of Pu	2 g ^{235}U in 6 standards and 3 g Pu in 4 standards[a/]	
India	Mass-spectrometric analysis of Pu	20 mg ^{242}Pu as PuO_2[a/]	
Mexico	Uranium enrichment services for two reactor units of nuclear power plant		
Indonesia	Fuel for a research reactor	2300 g ^{235}U	19.5%
Pakistan	Fuel for a research reactor over a five-year period	4650 g ^{235}U	93%
Peru	Analytical radiochemistry	1.76 mg ^{238}Pu in a portable analyser[a/]	
Thailand	Fuel for a research reactor	4100 g ^{235}U	86.9%
Venezuela	Fuel for a research reactor	2746 g ^{235}U	17.70%
Venezuela	Fuel for a research reactor	200 g ^{235}U	19.92%
Yugoslavia	Neutron activation research	0.04 mg ^{235}U and 0.04 mg ^{239}Pu on nickel foil[a/]	
Yugoslavia	Uranium enrichment services for one reactor unit of nuclear power plant		

a/ This request is being implemented by the Director General under the authority referred to above.

122. The allocation of special fissionable material to the value of $50 000 granted by the United States for 1973 is shown in Table 13 below.

Table 13

Allocation of special fissionable material granted by the United States for 1973

Receiving State	Value in dollars
Indonesia	6 455
Turkey	6 767
Venezuela	36 778
Total	50 000

Fast-breeder reactors

123. During the period covered by this report, the Agency convened several meetings on fast-breeder reactors, among them the symposium on fuel and fuel elements for fast reactors, which met in Brussels in July 1973 and examined the technological, economic and safety aspects of fast reactor fuel elements manufacture. A panel on principles of hot channel factor calculations held at Karlsruhe, Federal Republic of Germany in November 1973 reviewed methods of analysing power distribution in relation to the operation and safety of fast reactors.

124. The seventh annual meeting of the Agency's international working group on fast reactors held in the United Kingdom in March 1974 reviewed the national programmes of liquid-metal-cooled fast-breeder reactors and endeavoured to co-ordinate international meetings on this subject. The working group sponsored a specialists' meeting in June 1974 on handling of the design for, and mitigation of thermal transients in, liquid-metal-cooled fast-breeder reactor plants.

125. The working group also continued to give scientific support to other international meetings, namely the symposium on physics of fast reactors, held in Tokyo in October 1973, and the conference on fast reactor power stations, held in London in March 1974.

Advanced nuclear technology

126. A meeting of the joint Agency/NEA international liaison group on MHD electrical power generation held in Vienna in February 1974 gave special attention to the status of closed-cycle MHD research and to the influence of the world energy situation on prospects for closed-cycle liquid-metal MHD. The group prepared an international status report on MHD electrical power generation for the World Energy Conference to be held in Detroit, United States, in 1974.

Nuclear explosions for peaceful purposes

127. Within the framework of a decision of the General Conference that the Agency should, in conformity with its Statute, assume the functions of the international body provided for in Article V of NPT[29], the Agency has continued to develop an international service to

[29] See Resolution GC(XIII)/RES/258, para. 1 and document GC(XIII)/410.

assist States in securing the benefits from peaceful applications of nuclear explosions. It will be recalled that this work is also responsive to Resolution 2456 C (XXIII) of the General Assembly of the United Nations.

128. In April 1974, the Secretariat convened a group of experts with representation both from "supplier" States and non-nuclear weapon States to advise on detailed procedures for responding to requests from Member States for assistance in obtaining the services in question. The working group concentrated on drawing up procedures that would apply at the early stages in respect of such requests, including guidelines for requesting States and for the Agency. The recommendations of the working group will be submitted to the Board for approval in September 1974 and subsequently communicated to all Members.

NUCLEAR SAFETY AND ENVIRONMENTAL PROTECTION

General

129. Concern about the impact of nuclear energy on the environment led to a substantial expansion of the Agency's work on nuclear safety and environmental protection during the second part of 1973. Special contributions amounting to $152 941 were made by ten advanced countries for the activities carried out in 1973 relating to the protection of the environment and, in particular, the safe management of nuclear waste. The Agency gave particular attention to the problems of waste disposal in the oceans and to other questions of waste management.

130. In the first half of 1974 events that had an effect on the energy situation also began to influence this part of the Agency's work. The Agency started an important project, which may last two to three years, to establish standards for the siting and safety of nuclear power plants and to help the Agency respond to the needs of Member States in this regard.

131. The Agency expects a rapid increase in the number of requests for assistance in nuclear safety matters, as well as in the number of nuclear power projects to be reviewed from the safety point of view. This has necessitated an urgent reappraisal of Member States' needs and of the Agency's corresponding programme. The Agency has therefore started to prepare a comprehensive set of internationally acceptable safety requirements and guidelines for nuclear power plants. These will serve as a standard frame of reference for analyses of nuclear plant safety and reliability. The programme will integrate previous work, for instance, the recommendations of a panel relating to a code of practice for the safe design and construction of reactors held in August 1973. In April 1974 the Agency convened the first meeting of a committee of senior advisers, which will give guidance about the documentation to be issued and the mechanism for preparing these documents.

132. To help Member States review their local safety problems, the Agency sent safety missions to research reactor institutes in Mexico and Venezuela at the end of 1973. Siting missions were sent to Greece in July 1973, and to the Republic of Korea in October and November 1973 to help select the site for the third Korean nuclear power station and to review the safety of the power plant KORI-1. A further mission to the Republic of Korea in March 1974 gave advice on the safety implications of the technical specifications drawn up in the contract for a nuclear power plant. The Agency also sent safety missions to Yugoslavia and Mexico in April and June 1974. Furthermore studies have been invited on building nuclear power plants underground, a question of interest to a number of Member States.

Waste management

133. The Agency is drawing up general guidelines to provide Member States with the basic information and methodology needed to assess the capacity of the environment to accept radioactive materials.

134. The Board expects to consider in September 1974 the Secretariat's proposals for:

(a) The definition by the Agency of high-level radioactive matter unsuitable for dumping at sea; and

(b) The evaluation of applications for dumping and the control of dumping operations, in cases where sea disposal is not prohibited by the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter[30].

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[30] Reproduced in document INFCIRC/205.

135. With assistance from UNEP, the Agency convened a panel in April 1974 to review existing knowledge of the effects of ionizing radiation on aquatic organisms and ecosystems and to consider the perturbation that radiation can cause to such organisms.

136. Because of the sharply accelerated growth of nuclear energy, the management of high-level and alpha-bearing wastes, in particular wastes containing plutonium, is bound to become a serious problem in the future. The Agency has set up a working group to advise it in this field and to provide for a regular exchange of information; the first meeting was held in March 1974. UNEP is helping to finance related activities which also include the formulation of criteria for selecting sites for disposal of such wastes.

137. A symposium held in Vienna in November 1973 on the physical behaviour of radioactive contaminants in the atmosphere showed the need for further study of the models used to predict the dispersion of such contaminants. In this connection the Agency convened a research co-ordination meeting in California in December 1973 in order to obtain and exchange information about the results of research on the environmental behaviour of tritium. The research programme in question is providing valuable data about different ecosystems and climatic conditions.

138. The Agency has also begun a study of the safety problems involved in decommissioning nuclear facilities and, in particular, of the steps that should be taken to ensure that design features which will facilitate eventual decommissioning are incorporated into new plants.

Radiological safety

139. The Agency has postponed the revision of its Basic Safety Standards for Radiation Protection until the revised recommendations of ICRP become available, probably in 1975. The Agency and FAO are drafting guides on the principles and methods to be followed in order to establish derived working limits for radioactive contaminants in food chains. The Agency is also advising international transport organizations, such as IATA, about the incorporation of the revised Regulations for the Safe Transport of Radioactive Materials[31] in their own international regulations.

140. In November 1973 a symposium in Warsaw on environmental surveillance around nuclear installations reviewed the objectives and methods to be followed in such surveillance. It also discussed the establishment of surveillance programmes, as well as working limits for radioactive and certain non-radioactive contaminants released by the nuclear industry.

141. With the help of a consultant a survey has been made of the quantities and types of radioactive materials now being released by the nuclear industry and likely to be released between now and the year 2000. With the help of UNEP and WHO, the Agency is preparing recommendations concerning the extent to which new environmental monitoring systems may be needed by Governments, by regions and for the world as a whole.

142. The Agency has begun a study, with financial assistance from UNEP, of methods of evaluating the aggregate radiation dose that man receives from natural as well as artificial sources. This matter was the topic of a panel in Warsaw in November 1973 and of a joint IAEA/WHO/UNEP seminar in Portoroz in Yugoslavia in May 1974. To help Member States apply the Agency's standards and recommendations, the Agency organized regional study groups in Budapest in September 1973 and in Lima in November 1973, a training course in Mexico City in June 1974 and has sent out advisory missions.

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[31] Safety Series No. 6 (STI/PUB/323).

Research support

143. The current programme of support for research on nuclear safety and environmental protection is summarized in Table 14 below. A number of research co-ordination meetings have been held to plan and review the activities referred to.

Table 14

Research contracts on radiological and environmental protection

CRP	Countries in which research is carried out with Agency support	Cost to the Agency in 1973 (in dollars)
1. Migration and dispersion of radionuclides from storage of radioactive wastes	Argentina, Czechoslovakia, Greece, Philippines, Thailand	12 000
2. Study of integrated radioactive waste management systems	Egypt, Republic of Korea, Netherlands, Philippines	7 800
3. Cycling of the tritium and other radionuclides of global character in different types of ecosystems	Belgium[a], Finland, Federal Republic of Germany[a], Greece, Indonesia, Mexico, Philippines, Thailand, United States[a]	11 670
4. Physical and biological effects on the environment of cooling systems and thermal discharges from nuclear power stations	Canada[a], Federal Republic of Germany (2[a]), Indonesia, United States (2[a])	10 000
5. Environmental monitoring for radiobiological protection in Asia and the Far East	Bangladesh, Federal Republic of Germany[a], India, Indonesia, Pakistan, Philippines, Thailand	21 400
6. Marine radioactivity studies	Argentina, Belgium, Finland[a], France[a], India (1+1[a]), Iran, Italy[a], Japan[a], Republic of Korea, Netherlands, New Zealand, Romania[a], Turkey, United States, Yugoslavia	20 500
7. Nuclear accident dosimetry	Bulgaria, Canada[a], Czechoslovakia[a], France[a], Federal Republic of Germany[a], Hungary, India[a], Japan[a], Poland, Soviet Union[a], United Kingdom[a], United States[a], Yugoslavia	11 300

a/ Cost-free research agreement.

144. In addition to the CRPs listed in Table 14 above, research projects in relation to general matters of radiation protection are also being supported in Brazil, Czechoslovakia, India, Philippines, Poland, Romania, Soviet Union and United States. Projects concerning measurement techniques are supported in institutes in Austria, Belgium, Czechoslovakia, Israel, Republic of Korea and Netherlands. A total amount of some $42 000 was awarded in 1973 in conjunction with these projects.

INFORMATION AND TECHNICAL SERVICES

The International Nuclear Information System (INIS)

145. The Agency is now operating a comprehensive nuclear science information service, which provides national information centres with output in a variety of forms for transmission to the individual user.

146. By the end of December 1973, 44 Member States and 12 international, intergovernmental and non-governmental organizations were participating in INIS. With the achievement of full-scope operation in 1973, INIS will have processed 65 000 items of nuclear science information in the period covered by this report.

147. The second consultative meeting of INIS Liaison Officers was held in Vienna in November 1973. The meeting's main recommendations, which have been implemented, were:

(a) That INIS products, in both their printed and magnetic tape form should include a subject index;

(b) That the experimental inclusion of abstracts through the use of optical character-recognition devices should be studied; and

(c) That the price of INIS output products should not change in 1974, except for the addition of a fixed charge to cover mailing costs.

148. An INIS seminar on indexing and retrieval was held in June 1974 in Luxembourg. On-the-job training in INIS work was given during the year to seven trainees from five participating Member States.

149. Close co-operation is continuing with UNESCO, and the Agency has produced for FAO, on a cost-reimbursable basis, an experimental issue of the Agricultural Information System, thereby demonstrating that the INIS software can be used in other subjects.

Computer services

150. The IBM 370/145 computer serves both the Agency and UNIDO. The facility is now being operated on a three-shift basis and its use has increased by about 25% since the period covered by the previous report. The Agency has therefore been able to reduce the hourly charges to users.

SAFEGUARDING PEACEFUL NUCLEAR ACTIVITIES

Implementation of Agency safeguards

151. Table 16 at the end of this section shows the situation as at 30 June 1974, of signatures, ratifications and accessions with respect to NPT, and the progress made in the negotiation of safeguards agreements in connection therewith.

152. Table 17 shows the total number of safeguards agreements other than those connected with NPT, which had been approved by the Board and the parties concerned by 30 June 1974.

153. On 30 June 1974, 32 safeguards agreements with non-nuclear-weapon States party to NPT were in force; 19 of these agreements were with States that have significant nuclear activities. It should be noted that safeguards were also being applied under 11 project agreements, 24 safeguards transfer agreements and four unilateral submission agreements. All of the latter 39 agreements provide for the application of safeguards under the earlier Agency's Safeguards System (1965, as Provisionally Extended in 1966 and 1968)[32].

154. In particular, during the period covered by this report, the Board approved:

(a) In connection with NPT, safeguards agreements with Australia, Jordan, Swaziland and Thailand;

(b) In connection with both NPT and the Treaty for the Prohibition of Nuclear Weapons in Latin America (Tlatelolco Treaty), safeguards agreements with Bolivia, Ecuador, Haiti and Nicaragua;

(c) In connection with the Tlatelolco Treaty, a safeguards agreement with Panama;

(d) Two agreements respectively to amend the Safeguards Transfer Agreement between Spain, the United States and the Agency and the one between South Africa, the United States and the Agency; and

(e) Two unilateral submission agreements respectively with Chile and Spain for the application of safeguards to certain nuclear material.

155. Standardization in the application of safeguards has resulted in the updating of model Subsidiary Arrangements, and "Facility Attachments" for all types of nuclear facility where nuclear material is being safeguarded. The Secretariat is drawing up practices for implementing safeguards for each facility; in establishing these practices, the general procedures laid down in the Safeguards Technical Manual are systematically used and account is taken of the specific conditions at the facility. Models have been worked out for selected facilities and individual procedures for the remainder will be completed in the current year.

156. In preparation for the implementation of the safeguards agreement signed in April 1973 with EURATOM and its non-nuclear-weapon Member States, the Agency and EURATOM are holding periodic technical meetings, and agreement has been reached in principle on a series of typical "Facility Attachments". Agreement has also been reached on the detailed interpretation of the relevant accounting provisions, with a view to adapting the EURATOM practices accordingly.

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[32] Set forth in document INFCIRC/66/Rev.2.

157. A list of nuclear installations under Agency safeguards or containing material safeguarded under agreements approved by the Board is given in Annex E. The breakdown on 30 June 1974 as compared to 30 June 1973 is as follows:

Facilities	30 June 1973		30 June 1974	
	NPT	Non-NPT	NPT	Non-NPT
Nuclear power stations	7	20	12	24
Other reactors	45	62	45	65
Conversion plants, fabrication plants and fuel reprocessing plants	8	12	7	19
Other separate accountability areas	15	85	28	88

158. The following quantities of nuclear material were under Agency safeguards:

	1972	1973	1972	1973
	Total element		Fissionable isotope	
	kg	kg	kg	kg
(a) Special fissionable material				
Plutonium	2 901	4 731		
Enriched uranium	1 178 024	1 865 553	25 912	42 851
(b) Source material				
Natural uranium	1 840 019	3 119 092		
Depleted uranium	298 799	239 937		
Thorium	6 676	11 729		

159. During the year 1 July 1973-30 June 1974 the Agency carried out 434 inspections in 40 States (147 in connection with NPT), compared with 451 inspections (165 in connection with NPT) in 33 States during the preceding year.

160. Radiation measuring instruments have been increasingly used during inspections, and surveillance cameras were used for a total of 66 000 hours during 1973, compared with 40 000 in the preceding year.

161. The number of samples of safeguarded nuclear material taken during 1973 was 50% greater than in 1972. All analytical work was carried out at the Agency's laboratory in Seibersdorf, and shipment arrangements proved satisfactory.

162. Statistical techniques are being used increasingly for the verification of physical inventories and of flows of nuclear material.

Safeguards research and development

163. In the safeguards research and development programme, which is designed to make the implementation of safeguards as effective, economical and unintrusive as possible, special attention has been given, during the period covered by this report, to:

(a) Improving the handling of safeguards information;

(b) Helping States to develop their accounting and control systems of nuclear materials;

(c) Arranging services for analysing samples taken by inspectors; and

(d) Developing instruments and techniques, and in particular non-destructive assay techniques, that enable the Agency's inspectors to make measurements on nuclear materials without damaging them.

164. A computer-based information system on facility design and accounting of nuclear material data provided through reports was established and successfully tested. A simplified version of this system was put into routine use at the end of 1973 and the system as a whole will be fully implemented during the second half of 1974.

165. A panel on systems of accounting for and control of nuclear material was convened in Tokyo in November 1973. It considered such aspects of national systems as may have to be established by States to meet their obligations to the Agency under NPT-type safeguards agreements and to satisfy their internal requirements. The panel agreed on recommendations regarding the manner in which the Agency, in determining its own verification activities, should take account of work done under States' systems. The Agency is now preparing guidelines to assist States seeking its advice in setting up their systems of accounting for and control of nuclear material.

166. On 3 July 1973 the Agency and the Austrian Atomic Energy Research Organization signed an agreement for the lease to the Agency of the Safeguards Analytical Laboratory in which samples taken during inspections will be analysed. Construction is proceeding and it is expected that the Agency will be able to take over the laboratory in 1975.

167. In November 1973 the Agency began its first plutonium analysis field experiment which is designed to gain practical experience in carrying out analytical work in a network of national laboratories. The experiment has helped the Agency to draw up procedures for managing its analytical programme and establishing specifications for the quality of the analyses to be performed. A working group reviewed the results of the experiment in April 1974 and advised the Agency about future experiments for analysing plutonium and uranium in the input solution of fuel reprocessing plants.

168. In close co-operation with laboratories in Member States the Agency has developed new methods, using non-destructive assay techniques, to measure the content and isotopic ratio of plutonium and uranium in solid wastes from reprocessing facilities, in fabricated fuel elements and in large heterogeneous samples of nuclear material. New equipment has been used for this purpose. Progress is being made in the development of techniques for measuring uranium and plutonium concentration in small samples. The Agency has also developed the use of gamma measurement methods for verifying burn-up and cooling time of irradiated fuel, and for checking that no irradiated fuel elements have been removed from the fuel assemblies of material test reactors using highly-enriched fuel.

169. The Agency has developed and tested computer programmes for analysing isotopic composition data received from reprocessing plants and for systematic storage and retrieval of data that may be later used for verification purposes. Work is also being done on developing special-purpose tamper-indicating cameras and video systems for unattended surveillance of nuclear plants. The Agency is working out the procedures for applying safeguards in uranium enrichment facilities.

170. Research and technical contracts being carried out with the Agency's support are listed in Table 15 below.

Table 15

Contracts on safeguards research and development

Title	Institute	Agency contribution in dollars
Development and evaluation of NDA techniques for measurement of U and Pu at mixed oxide fuel fabrication plant	Centre d'étude de l'énergie nucléaire, Mol, Belgium	10 000
Development, demonstration and application of non-destructive instrumental techniques for assay of special nuclear material during fabrication of LWR fuel	Centre d'étude de l'énergie nucléaire, Mol, Belgium	2 500
Development, demonstration and application of non-destructive instrumental techniques for assay of PuO_2	Centre d'étude de l'énergie nucléaire, Mol, Belgium	1 000
Testing of prototype plutonium separation and detection equipment on waste streams from a reprocessing plant	Eurochemic, Mol, Belgium	2 700
Development, testing and utilization of instrumental techniques to determine quantities of plutonium in heterogeneous waste	Eurochemic, Mol, Belgium	11 000
Application of gamma spectrometry technique in combination with weighing for material balance taking in the production of highly-enriched U-Al fuel	Eldorado Nuclear Ltd., Port Hope, Ontario, Canada	3 400
Development of special gamma spectrometric detectors	Nuclear Research Institute, Prague	17 900
The application of gamma and isotopic correlation techniques for safeguards identification and verification purposes	Atomic Power Plant Bohunice, Jaslovake Bohunice, Czechoslovakia	12 500
Collection of gamma spectra data of irradiated light water moderated reactor spent fuel and study of the applicability of the method for fuel identification	Tokai Research Establishment Tokai-mura, Nakagun, Ibaragi-ken, Japan	5 200
Development of gallium arsenide gamma spectrometric detector	Electron Devices Laboratory Tokyo Shibaura Electric Co., Japan	14 700
Demonstration of an instrumental technique in the measurement of solution weight in the accountability vessels of a fuel reprocessing plant	Power Reactor and Nuclear Fuel Development Corp., Minato-ku, Tokyo	7 500
Development of physical inventory verification technique for FCA plutonium fuel plates	Japan Atomic Energy Institute, Tokai, Ibaraki, Japan	nil

Title	Institute	Agency contribution in dollars
Feasibility study for the safeguards use of NMR method for the isotopic assay of ^{235}U in UF_6 streams with different enrichments	Institute of Atomic Physics, Bucharest	7 300
Development and fabrication of mini gamma spectrometric probe for measurements of U in fuel clusters	Aktiebolaget Atomenergi, Nykoeping, Sweden	18 800
Study of safeguards procedures and techniques for critical (sub-critical) assemblies	V.I. Lenin Institute of Scientific Research, Dimitrovgrad, Soviet Union	14 000
Studies of safeguards procedures for international transfers of nuclear material	I.V. Kurchatov Institute of Atomic Energy, Moscow	nil
Nuclear material transfer monitor	United Kingdom Atomic Energy Authority, Risley, Warrington, Lancashire, United Kingdom	9 300
A portable gamma absorptiometer for safeguards use in nuclear fuel processing plants	United Kingdom Atomic Energy Authority, London	13 000
Development of a passive technique for measurement of special materials in bird-cage fuel storage safes	Atomic Energy Establishment, Winfrith, United Kingdom	5 350
Development and testing of irradiated fuel monitor for on-load fuelled reactor	Central Electricity Generating Board, Berkeley Nuclear Laboratory, United Kingdom	8 650

Table 16

Situation on 30 June 1974 with respect to the signature of, ratification of, or accession to, NPT by non-nuclear-weapon States, and the conclusion of safeguards agreements between the Agency and these States in connection with NPT

Non-nuclear-weapon States which have signed, ratified or acceded to NPT[a] (1)	Date of ratification or accession[a] (2)	Safeguards agreement with the Agency (3)
Afghanistan	4 February 1970	Under negotiation
Australia	23 January 1973	Approved by the Board
Austria	28 June 1969	In force: 23 July 1972
Barbados		Under negotiation
Belgium		Signed: 5 April 1973
Bolivia	26 May 1970	Approved by the Board
Botswana	28 April 1969	Under negotiation
Bulgaria	5 September 1969	In force: 29 February 1972
Burundi	19 March 1971	
Cameroon	8 January 1969	

(1)	(2)	(3)
Canada	8 January 1969	In force: 21 February 1972
Central African Republic	25 October 1970	
Chad	10 March 1971	
China, Republic of	27 January 1970	
Colombia		
Costa Rica	3 March 1970	Signed: 12 July 1973
Cyprus	16 February 1970	In force: 26 January 1973
Czechoslovak Socialist Republic	22 July 1969	In force: 3 March 1972
Dahomey	31 October 1972	
Denmark	3 January 1969	In force: 1 March 1972
Dominican Republic	24 July 1971	In force: 11 October 1973
Ecuador	7 March 1969	Approved by the Board
Egypt, Arab Republic of		
El Salvador	11 July 1972	Under negotiation
Ethiopia	5 February 1970	Under negotiation
Fiji	14 July 1972	In force: 22 March 1973
Finland	5 February 1969	In force: 9 February 1972
Gabon	19 February 1974	Under negotiation
Gambia		
German Democratic Republic	31 October 1969	In force: 7 March 1972
Germany, Federal Republic of		Signed: 5 April 1973
Ghana	5 May 1970	Signed: 23 August 1973
Greece	11 March 1970	Provisionally in force: 1 March 1972
Guatemala	22 September 1970	Under negotiation
Haiti	2 June 1970	Approved by the Board
Holy See	25 February 1971	In force: 1 August 1972
Honduras	16 May 1973	Under negotiation
Hungary	27 May 1969	In force: 30 March 1972
Iceland	18 July 1969	Signed: 12 July 1972
Indonesia		
Iran	2 February 1970	In force: 15 May 1974
Iraq	29 October 1969	In force: 29 February 1972
Ireland	1 July 1968	In force: 29 February 1972
Italy		Signed: 5 April 1973
Ivory Coast	6 March 1973	
Jamaica	5 March 1970	Under negotiation
Japan		
Jordan	11 February 1970	Approved by the Board
Kenya	11 July 1970	Under negotiation
Khmer Republic	2 June 1972	
Korea, Republic of		
Kuwait		
Laos	20 February 1970	Under negotiation
Lebanon	15 July 1970	In force: 5 March 1973
Lesotho	20 May 1970	In force: 12 June 1973
Liberia	5 March 1970	
Libyan Arab Republic		
Luxembourg		Signed: 5 April 1973
Madagascar	8 October 1970	In force: 14 June 1973
Malaysia	5 March 1970	In force: 29 February 1972

(1)	(2)	(3)
Maldives	7 April 1970	Under negotiation
Mali	5 March 1970	Under negotiation
Malta	6 February 1970	Under negotiation
Mauritius	28 April 1969	In force: 31 January 1973
Mexico	21 January 1969	In force: 14 September 1973
Mongolia	14 May 1969	In force: 5 September 1972
Morocco	30 November 1970	Signed: 30 January 1973
Nepal	5 January 1970	In force: 22 June 1972
Netherlands		Signed: 5 April 1973
Netherlands Antilles and Surinam		Signed: 5 April 1973
New Zealand	10 September 1969	In force: 29 February 1972
Nicaragua	6 March 1973	Approved by the Board
Nigeria	27 September 1968	Under negotiation
Norway	5 February 1969	In force: 1 March 1972
Panama		
Paraguay	4 February 1970	
Peru	3 March 1970	Under negotiation
Philippines	5 October 1972	Signed: 21 February 1973
Poland	12 June 1969	In force: 11 October 1972
Romania	4 February 1970	In force: 27 October 1972
San Marino	10 August 1970	Under negotiation
Senegal	17 December 1970	Under negotiation
Sierra Leone[b/]		Under negotiation
Singapore		
Somalia	5 March 1970	Under negotiation
Southern Yemen		
Sudan	31 October 1973	
Sri Lanka		
Swaziland	11 December 1969	Approved by the Board
Sweden	9 January 1970	Under negotiation
Switzerland		Under negotiation
Syrian Arab Republic	24 September 1969	
Thailand	7 December 1972	In force: 16 May 1974
Togo	26 February 1970	
Tonga	7 July 1971	Under negotiation
Trinidad and Tobago		
Tunisia	26 February 1970	Under negotiation
Turkey		
Upper Volta	3 March 1970	
Uruguay	31 August 1970	Signed: 24 September 1971
Venezuela		
Viet-Nam	10 September 1971	In force: 9 January 1974
Yemen, Arab Republic of		
Yugoslavia	3 March 1970	In force: 28 December 1973
Zaire, Republic of	4 August 1970	In force: 9 November 1972

a/ The information reproduced in columns (1) and (2), with the exception of that relating to Sierra Leone, was provided to the Agency by the 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.

b/ Has not yet acceded to NPT.

Table 17

Safeguards agreements other than those in connection with NPT, approved by the Board as of 30 June 1974

Party(ies)[a]	Subject	Entry into force	INFCIRC
Project Agreements			
Argentina	Siemens SUR-100	13 Mar 1970	143
	RAEP Reactor	2 Dec 1964	62
Chile	Herald Reactor	19 Dec 1969	137
Finland[b]	FiR-1 Reactor	30 Dec 1960	24
	FINN sub-critical assembly	30 Jul 1963	53
Greece[b]	GRR-1 Reactor	1 Mar 1972	163
Indonesia	Additional core-load for Triga Reactor	19 Dec 1969	136
Iran[b]	UTRR Reactor	10 May 1967	97
Japan	JRR-3	24 Mar 1959	3
Mexico[b]	TRIGA-III Reactor	18 Dec 1963	52
	Siemens SUR-100	21 Dec 1971	162
	Laguna Verde Nuclear Power Plant	12 Feb 1974	203
Pakistan	PRR Reactor	5 Mar 1962	34
	Booster rods for KANUPP	17 Jun 1968	116
Philippines	PRR-1 Reactor	28 Sep 1966	88
Romania[b]	TRIGA Reactor	30 Mar 1973	206
Spain	Coral I Reactor	23 Jun 1967	99
Thailand[b]	Fuel for TRR-1 Research Reactor		
Turkey	Sub-critical assembly	17 May 1974	
Uruguay	URR Reactor	24 Sep 1965	67
Venezuela	Fuel for RV-1 Research Reactor		
Viet-Nam[b]	VNR-1 Reactor	16 Oct 1967	106
Yugoslavia[b]	TRIGA-II Reactor	4 Oct 1961	32
	KRSKO Nuclear Power Plant	14 Jun 1974	
Zaire, Republic of[b]	TRICO Reactor	27 Jun 1962	37
Transfer Agreements (Agreements for transfer of safeguards under bilateral co-operation agreements between the indicated Parties)			
Argentina/USA		25 Jul 1969	130
Australia/USA		26 Sep 1966	91
Australia/Japan		28 Jul 1972	170/Corr.1
Austria[b]//USA		24 Jan 1970	152
Brazil/USA		20 Sep 1972	110/Mod.1
Canada/Japan		12 Nov 1969	85/Mod.1
Canada/India		30 Sep 1971	
China, Republic of/USA		6 Dec 1971	158
Colombia/USA		9 Dec 1970	144
Denmark[b]//UK		23 Jun 1965	63
Denmark[b]//USA		29 Feb 1968	112
France/Japan		22 Sep 1972	171
Greece[b]//USA		13 Jan 1966	78
India/USA		27 Jan 1971	154
Indonesia/USA		6 Dec 1967	109
Iran[b]/USA		20 Aug 1969	127
Israel/USA		15 Jun 1966	84
Japan/USA		10 Jul 1968	119
Japan/UK		15 Oct 1968	125
Korea/USA		19 Mar 1973	111/Mod.1
Pakistan/Canada		17 Oct 1969	135

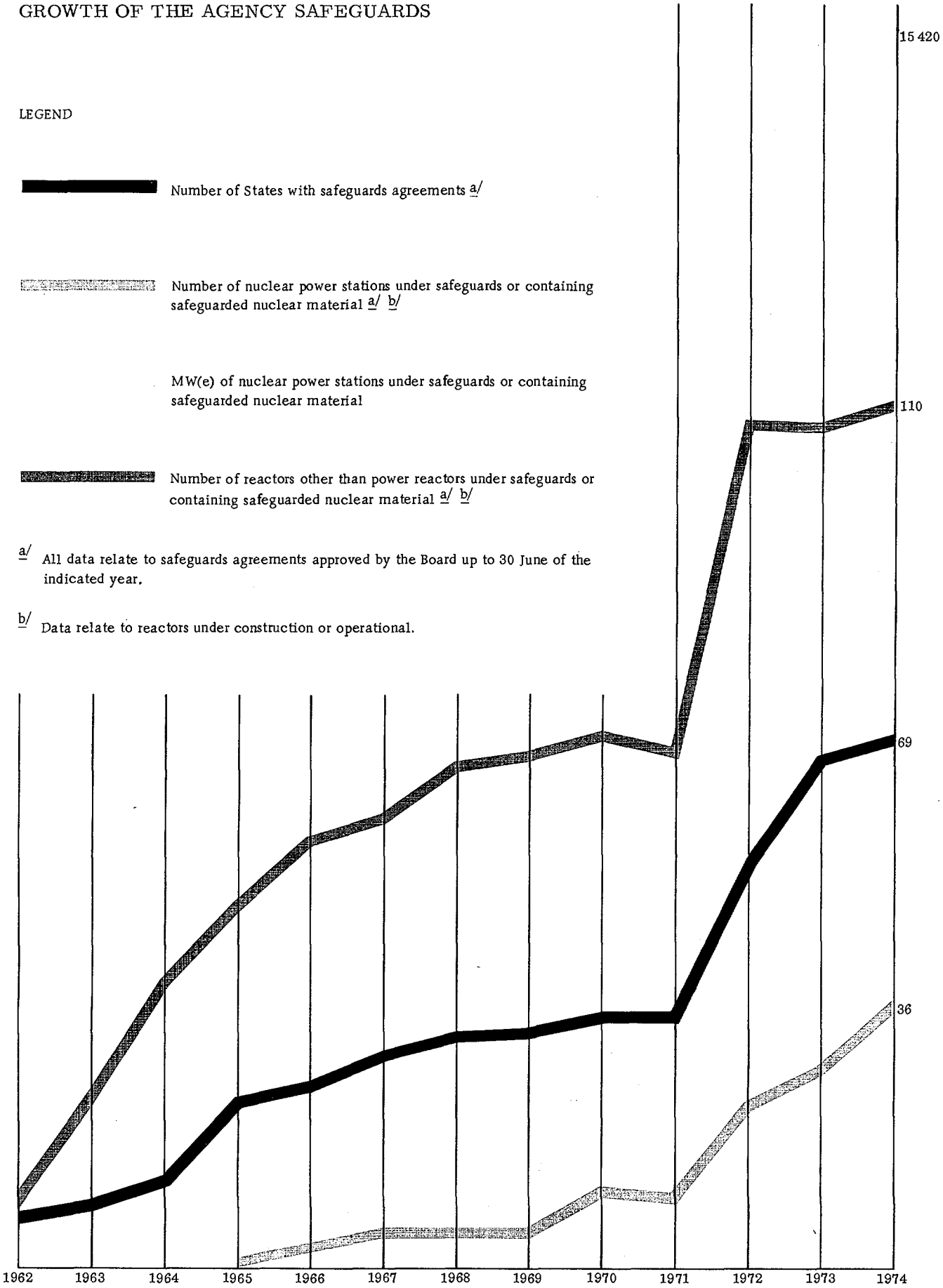
Party(ies)[a]	Subject	Entry into force	INFCIRC
Philippines/USA		19 Jul 1968	120
Portugal/USA		19 Jul 1969	131
South Africa/USA		26 Jul 1967	98
Spain/USA		9 Dec 1966	92
Sweden/USA		1 Mar 1972	165
Switzerland/USA		28 Feb 1972	161
Thailand[b]/USA		10 Sep 1965	68
Turkey/USA		5 Jun 1969	123
Venezuela/USA		27 Mar 1968	122
Viet-Nam[b]/USA		25 Oct 1965	71
Unilateral submissions			
Argentina	Atucha Power Reactor Facility	3 Oct 1972	168
	Nuclear material	23 Oct 1973	202
Chile	Nuclear material		
China, Republic of	Taiwan Research Reactor Facility	13 Oct 1969	133
Mexico[b/c]	All nuclear activities	6 Sep 1968	118
Panama[c]	All nuclear activities		
Spain	Nuclear material		
United Kingdom	Certain nuclear activities	14 Dec 1972	

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

c/ Concluded under Article 13 of the Treaty for the Prohibition of Nuclear Weapons in Latin America.

GROWTH OF THE AGENCY SAFEGUARDS



LEGEND

Number of States with safeguards agreements a/

Number of nuclear power stations under safeguards or containing safeguarded nuclear material a/ b/

MW(e) of nuclear power stations under safeguards or containing safeguarded nuclear material

Number of reactors other than power reactors under safeguards or containing safeguarded nuclear material a/ b/

a/ All data relate to safeguards agreements approved by the Board up to 30 June of the indicated year.

b/ Data relate to reactors under construction or operational.

ADMINISTRATION

EXTERNAL RELATIONS AND LEGAL MATTERS

171. Besides the negotiation of safeguards agreements in connection with NPT and other safeguards agreements with a number of States, the Secretariat has had informal exploratory talks with the Japanese authorities concerning an NPT safeguards agreement.

172. Co-ordination of the work of the Agency and WHO is proceeding smoothly and no longer requires special administrative arrangements. Accordingly the Agency's Liaison Office at WHO and the latter's Liaison Office at the Agency's Headquarters are being closed. The Agency will maintain an office at the Palais des Nations in Geneva for contacts with the United Nations and other Geneva-based organizations.

173. In the light of the improved prospects for the use of nuclear energy in developing countries, the Agency and the International Bank for Reconstruction and Development have increased their working contacts. No special questions of co-ordination have arisen in the Agency's relations with other organizations. An annual meeting with NEA for the purpose of avoiding duplication and pooling efforts, where desirable, was held in Vienna in March 1974 and a similar meeting with EURATOM in June 1973.

174. In April 1974, the Agency published a special issue of its Bulletin devoted to the energy situation.

175. Comparative information for the last two years in respect of symposia, conferences and seminars is given in Table 18 below.

Table 18

Conferences, symposia and seminars

Item	1972-73	1973-74
Meetings	14	13
Participants	2460	2037
Countries taking part	65	63
Papers presented	659	570

176. In May 1974, a group of experts discussed the problem of the relationship between the Vienna Convention on Civil Liability for Nuclear Damage and the Paris Convention on Third Party Liability in the Field of Nuclear Energy and examined a draft protocol intended to establish reciprocity of treatment between the parties to both Conventions. The protocol will be submitted to a meeting of the Agency's Standing Committee on Civil Liability for Nuclear Damage in late 1974 or early 1975.

177. Advice has been provided to the Iranian authorities on legislation required for the introduction of nuclear power including the establishment of a regulatory body. Similar advice has been given to the Government of Singapore and the Agency has assisted the Philippine authorities in drafting regulations for licensing nuclear power plants. One lawyer from the Federal Republic of Germany and one from Japan were trained in the legal aspect of atomic energy at the Agency's Headquarters.

PERSONNEL

178. On 30 June 1974 the Secretariat had 355 staff members in the Professional and higher categories, 582 in the General Service category and 233 in the Maintenance and Operatives Service category. The number of nationalities represented among that portion of staff which is subject to geographical distribution was 54, as compared to 56 on 30 June 1973.

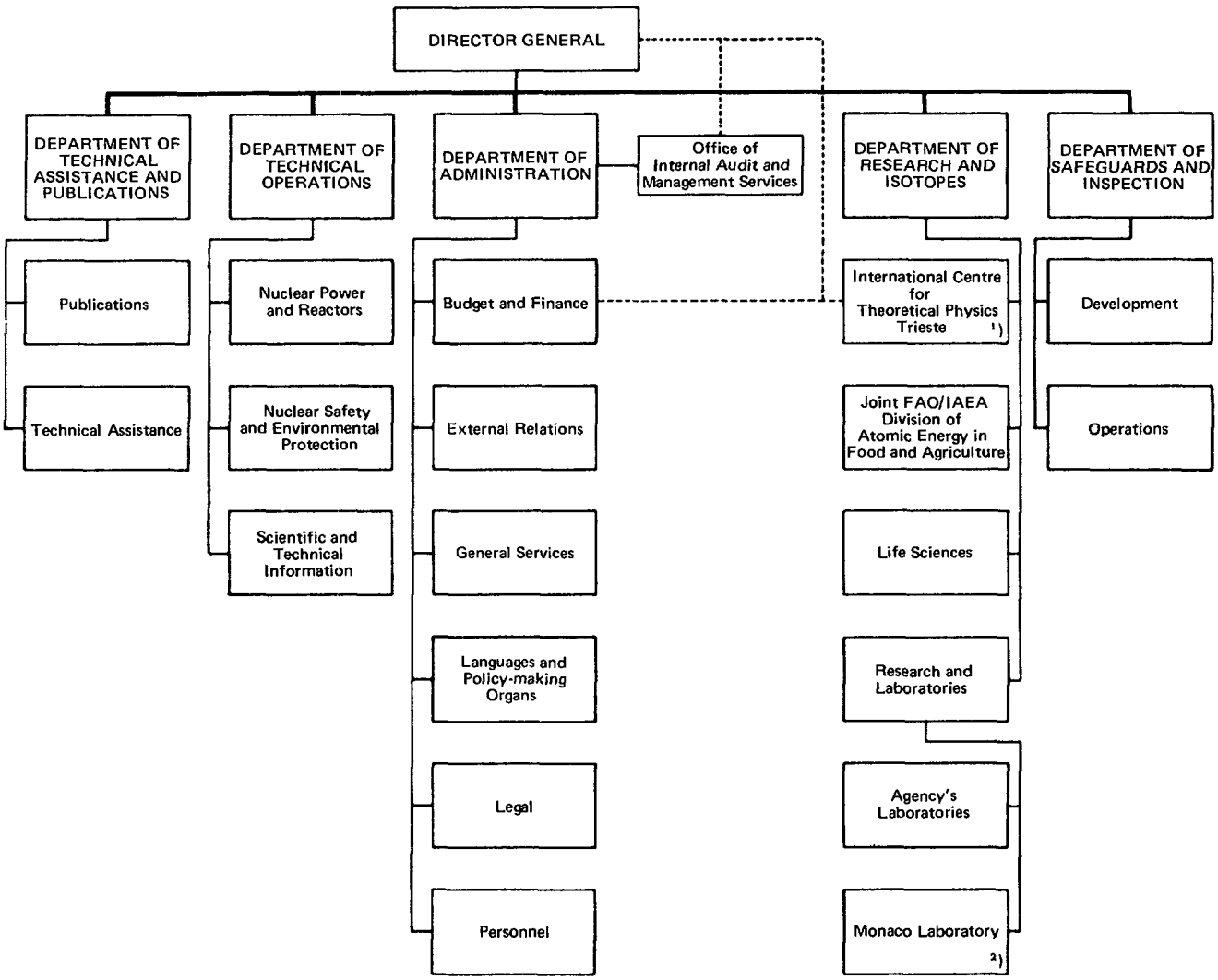
179. During the period covered by this report, a system of flexible working hours for staff was introduced on a voluntary and experimental basis.

180. The set of rules which will ensure adequate radiation protection to individuals for whose safety the Agency is responsible has been completed and related procedures are now being formulated.

181. The Agency and UNIDO have agreed to establish a working group to make recommendations about the services that could be administered jointly at the new permanent headquarters at present under construction for both organizations.

182. The following organizational chart shows the structure of the Secretariat as at 30 June 1974.

ORGANIZATIONAL CHART



1) Jointly operated by the Agency and UNESCO.
2) With the increasing participation of UNESCO and FAO.

FINANCE

Regular Budget

The financial year 1973

183. The original assessment of contributions on Member States included in the scale of assessment for 1973 amounted to $16 750 000; with the assessments for Bangladesh, the German Democratic Republic and Mongolia, which became Members after the scale for 1973 had been approved, the total increased to $16 990 787. The General Conference further approved a supplementary appropriation amounting to $1 630 000, resulting in a supplementary assessment of $1 250 000 on Member States. This became necessary to compensate for inflation since the original budget had been drawn up and for the effects of the realignment of currency exchange rates during 1973. The supplementary assessment on the new Members amounted to $17 970, so that the total assessment on Member States amounted to $18 258 757 for 1973.

184. By 31 December 1973 the following advances to the Working Capital Fund and contributions to the Regular Budget for 1973 had been received:

Advances to the Working Capital Fund	$ 2 023 650
Contributions to the Regular Budget for 1973	16 501 303
Supplementary appropriation for 1973	516 394

By 31 December 1973 Member States had thus paid 99.76% of the total required advances to the Working Capital Fund, 97.12% of the original 1973 assessment and 40.73% of the 1973 supplementary appropriation.

185. The Agency's obligations for 1973 amounted to $19 881 168, which resulted in budgetary savings of $54 618 from the appropriations for 1973. A further amount of $435 464, representing overruns of the supplementary budget estimates for assessments on the new Members, the final cash balance for 1972 and miscellaneous income brought the provisional budgetary surplus at 31 December 1973 to $490 082.[33] Since contributions in the amount of $1 241 060 were outstanding for 1973, there was a provisional cash deficit of $750 978 at the end of the year.

The financial year 1974

186. The General Conference approved the scale of assessment and Regular Budget appropriations for 1974 which involve assessment on Member States of an amount of $23 137 000[34]; with the assessment for the German Democratic Republic and Mongolia, which became Members after the scale for 1974 had been prepared, the total increased to $23 459 767.

187. By 30 June 1974 the following advances to the Working Capital Fund and contributions to the Regular Budget for 1974 had been received:

Advances to the Working Capital Fund	$ 2 023 491
Contributions to the Regular Budget for 1974	$11 013 929

By that date Member States had thus paid 99.80% of the total required advances to the Working Capital Fund and 46.95% of the total assessed contributions for 1974.

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[33] See Statement I. C of The Agency's Accounts for 1973, document GC(XVIII)/527.

[34] Resolution GC(XVII)/RES/304.

Operational Budget

188. At its sixteenth (1972) regular session, the Conference established a target for voluntary contributions of $3 million; 65 Member States pledged a total amount of $2 841 756 for 1973 or 94.73% of the target, the highest yet attained. By 31 December 1973 a total amount of $2 739 907 had been paid. By 30 June 1974, receipts amounted to $2 810 923, leaving a balance of $30 833 still to be paid.

189. The total obligations incurred during 1973 amounted to $5 461 490. Unliquidated obligations as at 31 December 1973, including obligations brought forward from the previous years, amounted to $1 697 008.

The Agency's resources in 1973

190. Resources equivalent to more than $25 million were available to the Agency during 1973 under its own programme, UNDP accounts and other special projects, including contributions in cash, in kind and in the form of services. Details concerning these resources are included in The Agency's Accounts for 1973. [35]

[35] Document GC(XVIII)/527.

ANNEX A

FELLOWSHIPS OFFERED OR PROVIDED FREE OF CHARGE IN 1973

Donor	Number of fellowships	
	Available	Awarded[a]
Member States		
Argentina	5	4
Austria	2	2
Belgium	6	5
Brazil	10	1
Bulgaria	2	-
Czechoslovak Socialist Republic	9	-
Denmark	5	4
Egypt, Arab Republic of	1	1
Finland	1	1
France	10	10
Germany, Federal Republic of	b/	24
Hungary	4	3
India	10	2
Israel	c/	1
Italy	20	17
Japan	10	10
Mexico	2	1
Netherlands	9	6
Pakistan	2	-
Philippines	2	-
Poland	10	6
Romania	10	1
Spain	5	5
Sweden	d/	7
Thailand	2	-
Union of Soviet Socialist Republics	d/	6
United States of America	40	44
Yugoslavia	e/	2
Regional organization		
Joint Institute for Nuclear Research, Dubna, Soviet Union	3	-

a/ As of 31 December 1973: number of awards less rejections and withdrawals.

b/ 360 man-months.

c/ 45 man-months.

d/ Awards made on basis of available funds.

e/ 30 man-months.

ANNEX B

RESEARCH CONTRACTS

I. Total value of contracts in 1973

Year	New contracts	Renewals	Total	Value
1972	115	82	197	750 520
1973	64	150	214	729 497

II. Analysis by subject matter of contracts awarded or renewed in 1973

Subject matter of research	Number of contracts placed	Number of contracts renewed	Agency payment in dollars
Nuclear technology			
Nuclear power and reactors	2	13	52 000
Waste management	3	9	51 470
Physics and chemistry	3	11	47 000
Radioisotopes and radiation applications in			
Agriculture	24	45	182 515
Food irradiation	2	10	47 735
Hydrology	2	4	27 200
Industry	1	5	19 000
Medicine	8	28	153 297
Protection of man and his environment			
Radiological safety	8	7	56 265
Radiation biology	8	13	65 125
Environmental research	2	2	16 500
Dosimetry	1	3	11 390
Total	64	150	729 497

ANNEX C

CONFERENCES, SYMPOSIA AND SEMINARS HELD DURING THE PERIOD 1 JULY 1973-30 JUNE 1974

Date and place	Title	Co-sponsoring organizations	Number of participants	Number of countries represented	Number of organizations represented	Number of papers presented
1973						
2-6 July Brussels	Symposium on Fuel and Fuel Elements for Fast Reactors		211	21	2	50
13-17 August Rochester, United States	Third Symposium on the Physics and Chemistry of Fission		194	20	2	61
27-31 August Otaniemi, Finland	Symposium on Nuclear Techniques in Comparative Studies of Food and Environmental Contamination	FAO WHO	106	23	3	46
1-5 October Vienna	Symposium on Isotopes and Radiation Techniques in Studies of Soil Physics, Irrigation and Drainage in Relation to Crop Production	FAO	52	22	5	33
10-14 September Istanbul, Turkey	Symposium on Radioimmunoassay and Related Procedures in Clinical Medicine and Research		269	42	-	66
8-12 October Vienna	Symposium on Experience from Operating and Fuelling of Nuclear Power Plants		188	35	3	45
22-26 October Neuherberg, Federal Republic of Germany	Symposium on the Effects of Neutron Irradiation upon Cell Function		91	19	6	35
5-9 November Warsaw	Symposium on Environmental Surveillance around Nuclear Installations		200	25	5	35
12-16 November Vienna	Symposium on the Physical Behaviour of Radioactive Contaminants in the Atmosphere	WMO	109	25	8	60
1974						
11-15 March Vienna	Symposium on Isotope Techniques in Ground-water Hydrology		198	39	5	51
6-10 May Athens	Symposium on the Formation of Uranium Ore Deposits		220	40	2	43
20-24 May Portoroz, Yugoslavia	Seminar on Radiological Safety Evaluation of Population Doses and Application of Radiological Safety Standards to Man and the Environment	WHO	164	35	3	45
25-28 June Luxembourg	INIS Seminar on Indexing and Retrieval	Commission of the European Communities	35	23	2	-

ANNEX D

STATUS OF FINANCIAL CONTRIBUTIONS TO THE AGENCY ON 30 JUNE 1974

1. Advances to the Working Capital Fund and contributions to the Regular Budget for 1974

Member State	Working Capital Fund			Regular Budget for 1974			
	Assessed	Paid	Outstanding	Assessed	Credit	Paid	Outstanding
Afghanistan	800	800	-	8 414	-	-	8 414
Albania	800	800	-	8 414	-	-	8 414
Algeria	1 800	1 800	-	18 932	-	18 932	-
Argentina	16 400	16 400	-	172 487	-	-	172 487
Australia	28 200	28 200	-	330 775	-	165 388	165 387
Austria	10 600	10 600	-	124 334	-	124 334	-
Bangladesh	2 800	1 271	1 529	29 449	-	-	29 449
Belgium	20 200	20 200	-	236 938	-	227 615	9 323
Bolivia	800	800	-	8 414	-	-	8 414
Brazil	15 400	15 400	-	161 969	-	-	161 969
Bulgaria	3 400	3 400	-	35 759	-	-	35 759
Burma	1 000	1 000	-	10 518	-	-	10 518
Byelorussian Soviet Socialist Republic	9 600	9 600	-	112 605	-	56 303	56 302
Cameroon	800	800	-	8 414	-	8 414	-
Canada	59 200	59 200	-	694 393	-	694 393	-
Chile	3 800	3 800	-	39 967	-	-	39 967
Colombia	3 600	2 890	710	37 862	-	-	37 862
Costa Rica	800	800	-	8 414	-	-	8 414
Cuba	3 000	3 000	-	31 604	9 250	-	22 354
Cyprus	800	800	-	8 414	-	8 414	-
Czechoslovak Socialist Republic	17 200	17 200	-	201 749	-	-	201 749
Denmark	11 800	11 800	-	138 410	200	138 210	-
Dominican Republic	800	680	120	8 414	-	-	8 414
Ecuador	800	800	-	8 414	-	-	8 414
Egypt, Arab Republic of	3 400	3 400	-	35 759	-	-	35 759
El Salvador	800	680	120	8 414	-	-	8 414
Ethiopia	800	800	-	8 414	-	8 414	-
Finland	8 600	8 600	-	100 875	-	100 875	-
France	115 200	115 200	-	1 351 250	200	1 294 136	56 914
Gabon	800	800	-	8 414	-	-	8 414
Germany, Federal Republic of	130 600	130 600	-	1 531 886	200	1 531 686	-
Ghana	1 400	1 400	-	14 724	-	-	14 724
Greece	5 600	5 600	-	58 898	-	44 934	13 964
Guatemala	1 000	1 000	-	10 518	-	-	10 518
Haiti	800	680	120	8 414	-	-	8 414
Holy See	800	800	-	9 384	-	9 384	-
Hungary	9 200	9 200	-	107 912	-	107 912	-
Iceland	800	800	-	9 384	-	9 384	-
India	29 800	29 800	-	313 422	-	295 778	17 644
Indonesia	5 400	5 400	-	56 962	-	3 233	53 729
Iran	4 200	4 200	-	44 173	-	-	44 173
Iraq	1 400	1 400	-	14 724	-	14 724	-
Ireland	2 800	2 800	-	32 843	-	32 843	-
Israel	3 800	3 800	-	44 573	-	44 573	-
Italy	68 000	68 000	-	797 613	-	-	797 613
Ivory Coast	800	800	-	8 414	-	-	8 414
Jamaica	800	800	-	8 516	-	4 597	3 919
Japan	103 600	103 600	-	1 215 187	-	1 215 187	-
Jordan	800	800	-	8 414	-	-	8 414
Kenya	800	800	-	8 414	-	5 593	2 821
Khmer Republic	800	800	-	8 414	-	-	8 414
Korea, Republic of	2 000	2 000	-	21 035	-	21 035	-
Kuwait	1 600	1 600	-	18 767	-	18 767	-
Lebanon	1 000	1 000	-	10 518	-	-	10 518
Liberia	800	800	-	8 414	-	471	7 943
Libyan Arab Republic	1 400	1 400	-	16 421	-	16 421	-

Member State	Working Capital Fund			Regular Budget for 1974			
	Assessed	Paid	Outstanding	Assessed	Credit	Paid	Outstanding
Liechtenstein	800	800	-	9 384	-	9 384	-
Luxembourg	1 000	1 000	-	11 730	-	11 730	-
Madagascar	800	800	-	8 414	-	8 414	-
Malaysia	2 000	1 530	470	21 035	-	-	21 035
Mali	800	680	120	8 414	-	-	8 414
Mexico	16 800	16 800	-	176 694	-	-	176 694
Monaco	800	800	-	9 384	-	9 384	-
Morocco	1 800	1 800	-	18 932	-	18 932	-
Netherlands	22 600	22 600	-	265 089	-	265 089	-
New Zealand	6 200	6 200	-	72 723	-	-	72 723
Niger	800	800	-	8 414	-	-	8 414
Nigeria	2 200	2 200	-	23 276	-	-	23 276
Norway	8 200	8 200	-	96 182	-	96 182	-
Pakistan	6 600	6 600	-	69 415	-	-	69 415
Panama	800	800	-	8 414	-	-	8 414
Paraguay	800	-	800	8 414	-	-	8 414
Peru	2 000	2 000	-	21 035	-	-	21 035
Philippines	6 000	6 000	-	63 105	-	-	63 105
Poland	27 000	27 000	-	283 973	-	154 276	129 697
Portugal	3 000	3 000	-	31 553	-	-	31 553
Romania	7 000	7 000	-	73 623	-	37 337	36 286
Saudi Arabia	1 400	1 400	-	14 724	-	14 724	-
Senegal	800	800	-	8 414	-	7 359	1 055
Sierra Leone	800	800	-	8 414	-	4 439	3 975
Singapore	1 000	1 000	-	10 518	-	10 518	-
South Africa	10 400	10 400	-	109 382	-	109 382	-
Spain	20 000	20 000	-	210 350	-	-	210 350
Sri Lanka	1 000	1 000	-	10 518	-	-	10 518
Sudan	800	800	-	8 516	-	-	8 516
Sweden	24 000	24 000	-	281 510	-	281 510	-
Switzerland	16 200	16 200	-	190 019	-	190 019	-
Syrian Arab Republic	800	800	-	8 414	-	541	7 873
Thailand	2 400	2 400	-	25 242	-	25 242	-
Tunisia	800	800	-	8 414	-	-	8 414
Turkey	6 800	6 800	-	71 518	-	-	71 518
Uganda	800	680	120	8 414	-	-	8 414
Ukrainian Soviet Socialist Republic	35 800	35 800	-	419 920	200	209 860	209 860
Union of Soviet Socialist Republics	272 200	272 200	-	3 192 797	400	1 596 199	1 596 198
United Kingdom of Great Britain and Northern Ireland	113 200	113 200	-	1 327 791	200	1 327 591	-
United States of America	629 400	629 400	-	7 382 611	-	-	7 382 611
Uruguay	1 400	1 400	-	14 761	-	-	14 761
Venezuela	7 800	7 800	-	82 037	-	-	82 037
Viet-Nam	1 400	1 400	-	14 724	-	14 724	-
Yugoslavia	7 200	7 200	-	75 726	-	55 726	20 000
Zaire, Republic of	800	800	-	8 516	-	-	8 516
Zambia	800	800	-	8 414	-	-	8 414
Sub-total	2 000 000	1 995 891	4 109	23 137 000	10 650	10 680 512	12 445 838
New Members[a]:							
German Democratic Republic	26 800	26 800	-	314 353	-	314 353	-
Mongolia	800	800	-	8 414	-	8 414	-
Sub-total	27 600	27 600	-	322 767	-	322 767	-
TOTAL	2 027 600	2 023 491	4 109	23 459 767	10 650	11 003 279	12 445 838
Per cent of assessment		99.80%				46.95%	

a/ The German Democratic Republic and Mongolia became Members on 18 and 20 September 1973 respectively.

2. Outstanding contributions to the Regular Budgets for the years 1958-1973

State	1958-1964[a]	1965	1966[b]	1967	1968	1969	1970	1971	1972	1973[b]	Total
Afghanistan	-	-	-	-	-	-	-	5 220	5 934	6 778	17 932
Albania	-	-	-	-	-	-	-	-	120	6 778	6 898
Argentina	-	-	-	-	-	-	-	-	-	3 249	3 249
Bangladesh	-	-	-	-	-	-	-	-	-	471	471
Bolivia	-	-	-	-	2 794	4 355	4 741	5 221	5 934	6 778	29 823
Burma	-	-	-	-	-	-	-	-	-	588	588
Chile	-	-	-	-	-	-	-	-	-	8 831	8 831
Colombia	-	-	-	-	-	-	-	-	25 236	30 498	55 734
Costa Rica	-	-	-	-	-	-	-	-	-	1 584	1 584
Czechoslovak Socialist Republic	-	-	-	-	-	-	-	-	-	10 847	10 847
Dominican Republic	10 186	3 857	3 467	3 670	4 065	4 355	4 741	5 221	5 934	6 778	52 274
Ecuador	-	-	-	-	-	920	4 741	5 221	5 934	6 778	23 594
Egypt, Arab Republic of	-	-	-	-	-	-	-	-	-	11 904	11 904
El Salvador	-	-	-	-	-	4 124	4 741	5 221	5 934	6 778	26 798
Gabon	-	-	-	-	-	-	-	-	-	471	471
Guatemala	-	-	-	-	-	-	-	-	7 143	8 472	15 615
Haiti	15 214	3 085	3 467	3 670	4 065	4 355	4 741	5 221	5 934	6 778	56 530
Honduras[c]	2 020	3 085	3 467	3 670	-	-	-	-	-	-	12 242
Iran	-	-	-	-	-	-	-	-	-	2 457	2 457
Italy	-	-	-	-	-	-	-	-	-	42 885	42 885
Ivory Coast	-	-	-	-	-	-	-	-	-	471	471
Jordan	-	-	-	-	-	-	-	-	-	591	591
Khmer Republic	-	-	-	-	-	-	-	-	-	3 744	3 744
Lebanon	-	-	-	-	-	-	-	-	-	588	588
Malaysia	-	-	-	-	-	-	-	-	-	16 943	16 943
Mali	-	-	-	2 322	4 065	4 355	4 741	5 221	5 934	6 778	33 416
Mexico	-	-	-	-	-	-	-	-	-	9 717	9 717
Nicaragua[d]	-	-	-	-	-	-	3 707	-	-	-	3 707
Niger	-	-	-	-	-	-	-	-	-	471	471
Nigeria	-	-	-	-	-	-	-	-	-	1 322	1 322
Panama	-	-	-	-	-	-	-	-	-	978	978
Paraguay	16 919	3 085	3 467	3 670	4 065	4 355	4 741	5 341	5 934	6 778	58 355
Peru	-	-	-	-	-	-	-	-	-	14 513	14 513
Philippines	-	-	-	-	-	-	-	-	-	3 544	3 544
Spain	-	-	-	-	-	-	-	-	-	9 487	9 487
Sri Lanka	-	-	-	-	-	-	-	-	-	588	588
Uganda	-	-	-	-	-	-	4 507	5 221	5 934	6 778	22 440
United States of America	-	-	-	-	-	-	-	-	-	396 567	396 567
Uruguay	-	-	-	-	-	-	-	-	380	12 063	12 443
Venezuela	-	-	-	-	-	-	-	-	-	51 620	51 620
Zaire, Republic of	-	-	-	-	-	-	-	-	6 063	6 981	13 044
Zambia	-	-	-	-	-	-	-	-	-	4 042	4 042
Total outstanding	44 339	13 112	13 868	17 002	19 054	26 819	41 401	47 108	92 348	724 267	1 039 318
Total paid	42 402 707	7 719 170	8 663 691	9 168 008	10 152 576	10 884 634	11 829 379	13 299 551	15 305 586	17 534 490	146 959 792
Total assessed	42 447 046	7 732 282	8 677 559	9 185 010	10 171 630	10 911 453	11 870 780	13 346 659	15 397 934	18 258 757	147 999 110
% of assessment	99.90	99.83	99.84	99.81	99.81	99.75	99.65	99.65	99.40	96.03	99.30

a/ See Part 3 below.

b/ Includes supplemental assessments.

c/ Withdrew from membership on 19 June 1967.

d/ Withdrew from membership on 14 December 1970.

3. Details of outstanding contributions to the Regular Budgets for the years 1958-1964

State	1958	1959	1960	1961	1962	1963	1964	Total
Dominican Republic	-	-	-	-	3 015	3 561	3 610	10 186
Haiti	-	2 021	2 337	2 467	2 652	2 849	2 888	15 214
Honduras	-	-	-	-	-	-	2 020	2 020
Paraguay	1 636	2 090	2 337	2 467	2 652	2 849	2 888	16 919
Total outstanding	1 636	4 111	4 674	4 934	8 319	9 259	11 406	44 339
Total paid	4 113 124	5 220 889	5 876 306	6 195 756	6 631 760	7 146 004	7 218 868	42 402 707
Total assessed	4 114 760	5 225 000	5 880 980	6 200 690	6 640 079	7 155 263	7 230 274	42 447 046
Per cent of assessment	99.96	99.92	99.92	99.92	99.87	99.87	99.84	99.90

4. Voluntary contributions to the General Fund for 1973 and 1974

Notes: 1. All contributions pledged have been fully paid except as indicated in the "Outstanding" columns.

2. A fully or partially paid pledge made in a currency other than the United States dollar is expressed in dollars at the rate of exchange of the United Nations Development Programme current at the time payment was made. For pledges in respect of which no payment has yet been received, the current rate at the time of pledging has been applied.

Member State	For 1973		For 1974	
	Pledged	Outstanding	Pledged	Outstanding
Afghanistan	-	-	-	-
Albania	-	-	-	-
Algeria	2 700	-	-	-
Argentina	24 600	24 600	24 600	24 600
Australia	46 300	-	46 300	2 000
Austria	15 900	-	15 900	-
Bangladesh	-	-	-	-
Belgium	25 000[a/]	-	-	-
Bolivia	-	-	-	-
Brazil	30 000	-	30 000	30 000
Bulgaria	5 100	-	5 100	5 100
Burma	1 000[a/]	-	-	-
Byelorussian Soviet Socialist Republic	-	-	-	-
Cameroon	1 200	-	1 200	-
Canada	88 800	-	88 800	-
Chile	1 000[a/]	1 000	-	-
Colombia	-	-	-	-
Costa Rica	-	-	800[b/]	800
Cuba	4 500	-	5 521	5 521
Cyprus	1 200	-	-	-
Czechoslovak Socialist Republic	27 778	-	27 778	-
Denmark	21 540	-	21 240	-
Dominican Republic	-	-	-	-
Ecuador	-	-	-	-
Egypt, Arab Republic of	12 778	-	12 778	12 778

Member State	For 1973		For 1974	
	Pledged	Outstanding	Pledged	Outstanding
El Salvador	-	-	-	-
Ethiopia	-	-	-	-
Finland	12 900	-	16 800	-
France	77 418[a]	-	120 000[b]	-
Gabon	-	-	-	-
German Democratic Republic	35 156[a]	-	41 667	41 667
Germany, Federal Republic of	196 200	-	220 000	-
Ghana	2 200	-	2 200	2 200
Greece	8 400	-	8 400	8 400
Guatemala	-	-	-	-
Haiti	-	-	-	-
Holy See	3 000	-	3 000	-
Hungary	14 115	-	20 080	-
Iceland	-	-	1 200	-
India	45 000	-	50 000	-
Indonesia	8 100	3 233	8 100	8 100
Iran	7 300	-	7 000	7 000
Iraq	2 100	-	-	-
Ireland	4 200	-	5 600	-
Israel	5 700	-	6 300	-
Italy	96 600[a]	-	-	-
Ivory Coast	680[a]	-	-	-
Jamaica	-	-	-	-
Japan	155 700	-	259 000	-
Jordan	-	-	-	-
Kenya	-	-	-	-
Khmer Republic	-	-	-	-
Korea, Republic of	3 000	-	3 000	-
Kuwait	1 500[a]	-	2 400	-
Lebanon	-	-	-	-
Liberia	-	-	-	-
Libyan Arab Republic	-	-	-	-
Liechtenstein	1 200	-	1 400	-
Luxembourg	-	-	-	-
Madagascar	1 200	-	1 200	1 200
Malaysia	-	-	-	-
Mali	-	-	-	-
Mexico	25 500	-	30 000	30 000
Monaco	2 000	-	2 000	-
Mongolia	-	-	-	-
Morocco	2 700	-	-	-
Netherlands	40 000	-	40 000	-
New Zealand	9 361	-	-	-
Niger	-	-	-	-
Nigeria	3 300	-	-	-
Norway	12 300	-	12 500	12 500
Pakistan	8 250[a]	-	5 000[b]	5 000
Panama	-	-	1 200	-
Paraguay	-	-	-	-
Peru	-	-	3 000	3 000

Member State	For 1973		For 1974	
	Pledged	Outstanding	Pledged	Outstanding
Philippines	8 000[a]	-	9 000	-
Poland	15 060[a]	-	22 590	22 590
Portugal	4 500	-	4 500	4 500
Romania	10 500	-	10 500	5 775
Saudi Arabia	2 100	-	2 100	-
Senegal	-	-	-	-
Sierra Leone	-	-	-	-
Singapore	1 500	-	1 600	-
South Africa	15 600	-	17 100	17 100
Spain	30 000	-	30 000	30 000
Sri Lanka	1 460[a]	-	1 500	1 500
Sudan	1 200	-	2 500	2 500
Sweden	36 000	-	44 048	-
Switzerland	24 300	-	24 300	24 300
Syrian Arab Republic	-	-	-	-
Thailand	4 000	-	4 000	-
Tunisia	-	-	-	-
Turkey	10 200	-	11 000	-
Uganda	-	-	-	-
Ukrainian Soviet Socialist Republic	-	-	-	-
Union of Soviet Socialist Republics	449 383	-	542 162	72 993
United Kingdom of Great Britain and Northern Ireland	174 777	-	201 330	201 330
United States of America	945 600[c]	-	950 000[c]	916 220
Uruguay	-	-	-	-
Venezuela	-	-	-	-
Viet-Nam	2 100	-	2 100	-
Yugoslavia	9 000[a]	-	10 800	10 800
Zaire, Republic of	2 000	2 000	-	-
Zambia	-	-	-	-
TOTAL	2 841 756	30 833	3 042 194	1 509 474

a/ Pledge is less than the Member's Regular Budget assessment ratio (General Conference Resolution GC(XVI)/RES/295), applied to the target of $3 million of voluntary contributions set by Resolution GC(XVI)/RES/293.

b/ Pledge is less than the Member's Regular Budget assessment ratio (Resolution GC(XVII)/RES/308), applied to the target of $3 million of voluntary contributions set by Resolution GC(XVII)/RES/305, para. 1.

c/ When making this pledge, the United States of America also pledged to make contributions in kind in the form of cost-free experts, equipment for technical assistance, laboratory equipment, special nuclear materials Type II Fellowships, to a total value of approximately $804 000 for the year 1973 and $1 050 000 for the year 1974. It is to be noted that other members as well contribute to the Agency's resources in this way, and information relating to all such contributions is provided in the Agency's accounts for the respective year.

ANNEX E

NUCLEAR INSTALLATIONS UNDER AGENCY SAFEGUARDS OR CONTAINING SAFEGUARDED MATERIAL UNDER AGREEMENTS APPROVED BY THE BOARD OF GOVERNORS[a]

A. Reactors[b] other than power reactors

State	Abbreviated name of reactor	Location	Type	Capacity MW(th)	In operation
Argentina	RA-O	Cordoba	Tank	.00	x
	RA-1	Constituyentes	Argonaut	.12	x
	RA-2	Constituyentes	Argonaut	.03	x
	RA-3	Ezeiza	Pool-tank	5.00	x
	RA-4	Rosario	Solid-homogeneous	.00	x
Australia	HIFAR	Lucas Heights, N.S.W.	Tank	11.00	x
	MOATA	Lucas Heights, N.S.W.	Argonaut	.01	x
	FCA	Lucas Heights, N.S.W.	Critical Assembly	.00	x
Austria[c]	SAR	Graz	Argonaut	.00	x
	TRIGA-VIENNA	Vienna	Triga II	.25	x
	ASTRA	Seibersdorf	Pool	12.00	x
Brazil	IEA-R1	São Paulo	Pool	5.00	x
	IPR-R1	Belo Horizonte	Triga I	.10	x
	RIEN.1	Rio de Janeiro	Argonaut	.01	x
Bulgaria[c]	IRT-2000	Sofia	Pool	2.00	x
Canada[c]	NRX	Chalk River, Ont.	NRX	30.00	x
	NRU	Chalk River, Ont.	NRU	125.00	x
	WNRE	Pinawa, Manitoba	Organic-cooled	60.00	x
	McMaster	Hamilton, Ont.	Pool-type	2.5	x
	Slowpoke - Toronto	Univ. of Toronto	Pool-type	.00	x
	Slowpoke - Ottawa	Ottawa, Ont.	Pool-type	.02	x
	PTR	Chalk River, Ont.	Pool-type	.00	x
	ZED-2	Chalk River, Ont.	Pool-type	.00	x
	ZEEP	Chalk River, Ont.	Tank	.00	x
Chile	Herald	Santiago	Herald	5.00	-
China	THOR	Hsin-chu	Pool	1.00	x
	TRR	Huaitzupu	NRX	40.00	x
	ZPRL	Lung-Tan	Pool	.01	x
Colombia	IAN-R1	Bogotá	Pool-type	.02	x
Czechoslovak Socialist Republic[c]	SR-O	Vochov	Critical Assembly	.00	x
	VVR-S	Rez	Tank	4.00	x
	TR-O	Rez	Critical Assembly	.00	-
Denmark[d]	DR-1	Risø	Homogeneous	.00	x
	DR-2	Risø	Pool	5.00	x
	DR-3	Risø	Tank	10.00	x
Finland[c]	FiR-1	Otaniemi	Triga II	.25	x
German Democratic Republic[c]	WWR-S(M)	Rossendorf	Tank	6.00	x
	Rake II	Rossendorf	Critical Assembly	.00	x
	RRR	Rossendorf	Critical Assembly	.00	x
Greece[c]	GRR-1	Athens	Pool	5.00	x
Hungary[c]	WWR-SM	Budapest	Tank	5.00	x
	ZR-4	Budapest	Critical Assembly	.00	x
	ZR-6	Budapest	Critical Assembly	.00	x
	Training reactor	Budapest	Tank	.01	x
Indonesia	PRAP (TRIGA II)	Bandung	Triga II	1.00	x

State	Abbreviated name of reactor	Location	Type	Capacity MW(th)	In operation
Iran[c/]	UTRR	Teheran	Pool	5.00	x
Iraq[c/]	IRT-2000	Baghdad	Pool	2.00	x
Israel	IRR-1	Soreq	Pool	5.00	x
Japan	AHCF	Tokai-Mura	Critical Facility	.00	x
	DCA	Oarai-Machi	Critical Facility	.00	x
	FCA	Tokai-Mura	Critical Facility	.01	x
	HCA	Kawasaki-shi	Critical Facility	.00	x
	HTR	Kawasaki-shi	Pool	.10	x
	JMTR	Oarai-Machi	Tank	50.00	x
	JMTR-CA	Oarai-Machi	Critical Facility	.00	x
	JPDR	Tokai-Mura	Boiling-water	90.00	x
	JRR-2	Tokai-Mura	Tank	10.00	x
	JRR-3	Tokai-Mura	Tank	10.00	x
	JRR-4	Tokai-Mura	Pool	1.00	x
	Kinki University	Kowakai	UTR-B	.00	x
	KUR	Kumatori-cho	Pool	5.00	x
	KUCA	Kumatori-cho	Critical Facility	.00	x
	MCF	Ohmiya	Critical Facility	.00	x
	Musashi College of Technology	Kawasaki-shi	Triga II	.10	x
	NAIG-CA	Kawasaki-shi	Critical Facility	.00	x
	Rikkyo University	Nagasaka	Triga II	.10	x
	SHCA	Tokai-Mura	Critical Facility	.00	x
	TCA	Tokai-Mura	Critical Facility	.00	x
	TODAI	Tokai-Mura	Fast Neutron Source Reactor	.002	x
	TTR	Kawasaki-shi	Pool	.10	x
	"Mutsu" (Nuclear Ship)	Minato-Machi Mutsu	PWR	36.00	x
Korea, Republic of	KRR - TRIGA II	Seoul	Triga II	.10	x
	KRR - TRIGA III	Seoul	Triga III	2.00	x
Mexico[c/]	RCN	Salazar	Triga III	1.00	x
	SUR-100	Mexico City	Solid homogenous	.00	x
Norway[c/]	JEEP-II	Kjeller	Tank	2.00	x
	HBWR	Halden	HBWR	25.00	x
Pakistan	PARR	Rawalpindi	Pool	5.00	x
Philippines[c/]	PRR-1	Diliman, Quezon City	Pool	1.00	x
Poland[c/]	EWA	Świerk	Tank	8.00	x
	Maryla	Świerk	Critical Assembly	.00	x
	Anna	Świerk	Critical Assembly	.00	x
	Agata	Świerk	Critical Assembly	.00	x
Portugal	RPI	Sacavem	Tank	1.00	x
Romania[c/]	VVR-S	Margurele	Tank	10.00	x
South Africa	SAFARI-1	Pelindaba	Tank	20.00	x
Spain	JEN-1	Madrid	Pool	3.00	x
	JEN-2	Madrid	Pool	.00	x
	CORAL-1	Madrid	Fast Critical Facility	.00	x
	ARBI	Bilbao	Argonaut	.01	x
	ARGOS	Barcelona	Argonaut	.01	x
Sweden	R2	Studsvik	MTR Tank	50.00	x
	R2-0	Studsvik	Pool	1.00	x
	R-0	Studsvik	Pool	.00	x
Switzerland	Proteus	Würenlingen	Fast thermal Critical Assembly	.00	x
	Saphir	Würenlingen	Pool	5.00	x
	Diorit	Würenlingen	HW	30.00	x
	Crocus	Lausanne	Critical Assembly	.00	x
	AGN201P	Geneva	Solid homogeneous	.00	x
	AGN211P	Basel	Pool	.00	x

State	Abbreviated name of reactor	Location	Type	Capacity MW(th)	In operation
Thailand[c/]	TR-1	Bangkok	Pool	1.00	x
Turkey	TR-1	Istanbul	Pool	1.00	x
United Kingdom	Zebra	Winfrith	Critical Facility	.00	x
Uruguay[c/]	RUDI	Montevideo	Lockheed	.10	-
Venezuela	RV-1	Caracas	Pool	3.00	x
Viet-Nam[c/]	VNR-1	Dalat	Triga II	0.25	x
Yugoslavia[c/]	Triga II	Ljubljana	Triga II	0.25	x
	RA	Vinča	Heavy-water	6.5	x
	RB	Vinča	Critical Facility	.00	x
Zaire, Republic of[c/]	Triga	Kinshasa	Triga II	1.00	x

B. Nuclear power stations

State	Name of power station	Location	Type	Capacity MW(e)	In operation
Argentina	Atucha Nuclear Power Station	Atucha	PHWR	319	x
Bulgaria[c/]	Kozloduy I		PWR	440	-
Canada[c/]	Pickering (4 units)	Pickering, Ontario	Candu	2032	x
	NPD	Ralphton, Ontario	Candu	22	x
	Gentilly	Gentilly, Quebec	Candu	250	x
	DPGS	Kincardine, Ontario	Candu	208	x
	Bruce I	Douglas Point, Ontario	Candu	750	-
Czechoslovak Socialist Republic[c/]	A1	Bohunice	HWGC	110	x
German Democratic Republic[c/]	Rheinsberg PWR	Rheinsberg	PWR	80	x
	Greifswald PWR	Greifswald	PWR	880	x (for 440)
India	Tarapur - TAPS	Tarapur	BWR	380	x
	Rajasthan - RAPS	Rajasthan	Candu	400	x (for 200)
Japan	Tokai	Tokai-Mura	Magnox	154	x
	Tsuruga	Tsuruga	BWR	357	x
	Mihama-1	Mihama-Fukai	PWR	340	x
	Mihama-2	Mihama-Fukai	PWR	500	x
	Fukushima-1	Okuma-Fukushima	BWR	460	x
	Fukushima-2	Okuma-Fukushima	BWR	784	-
	Fukushima-3	Okuma-Fukushima	BWR	784	-
	Shimane	Kashima-cho	BWR	460	-
	Hamaoka 1	Hamaoka	BWR	540	-
	Takahama I	Takahama	PWR	826	-
Pakistan	KANUPP	Karachi	Candu	125	x
Spain	José Cabrera	Almonacid de Zorita	PWR	153	x
	Santa Maria de Garona	Province de Burgos	BWR	440	x
Sweden	Ågesta	Stockholm	PHWR	12	x
	Oskarshamn I	Oskarshamn	BWR	440	x
	Oskarshamn II	Oskarshamn	BWR	580	-
	Ringhals I	Near Göteborg	BWR	760	x
	Ringhals II	Near Göteborg	BWR	830	-
Switzerland	Mühleberg	Mühleberg	BWR	306	x
	Beznau I	Beznau	PWR	350	x
	Beznau II	Beznau	PWR	350	x

C. Conversion plants, fabrication plants and chemical reprocessing plants

Argentina	Pilot Fuel Reprocessing Plant, Ezeiza[e/] Pilot Fuel Fabrication Plant, Constituyentes[e/] Scrap Reprocessing Plant, Buenos Aires[e/]
Brazil	Fabrication Facility, Metallurgy Department,[e/] Instituto de Energia Atomica, São Paulo
Canada[c/]	Eldorado Nuclear Limited Port Hope Refinery Westinghouse Fuel Fabrication Plant Canadian General Electric Pelletizing Facility Canadian General Electric Fuel Fabrication Plant
China	INER Pilot Fuel Reprocessing Plant[e/]
Czechoslovak Socialist Republic[c/]	Nuclear Fuel Institute, Zbraslav
Denmark[c/]	Metallurgy Department, Risø[e/]
India	Nuclear Fuel Complex - NFC (Enriched Uranium Conversion and Fabrication Plant), Hyderabad
Japan	Nuclear Fuel Industries Ltd. (Kumatori-1) Sumitomo Metal Mining Co. Ltd. (Tokai-1) Mitsubishi Atomic Power Industries (Ohmiya-1) Japan Nuclear Fuel Co. Ltd. Mitsubishi Nuclear Fuel Co. Ltd. Pilot Fuel Fabrication Plants: Mitsubishi Atomic Power Industries (Ohmiya 2)[e/] Nuclear Fuel Industries Ltd. (Kumatori-2)[e/] Nuclear Fuel Industries Ltd. (Ohi)[e/] Nuclear Fuel Industries Ltd. (Takeyama-2)[e/] Power Reactor and Nuclear Fuel Development Co. (Tokai)[e/]
Norway[c/]	Fuel Element Pilot Production Plant, Kjeller[e/]
Spain	Pilot Reprocessing Plant, Juan Vigon Research Centre, Madrid[e/] Metallurgical Plant, Juan Vigon Research Centre, Madrid[e/]
Sweden	ASEA-ATOM, Västerås

a/ The nuclear installations that will be covered by the Safeguards Agreement in connection with NPT, signed with EURATOM and the non-nuclear-weapon States members of EURATOM on 5 April 1973, are not listed here.

b/ As defined in documents INFCIRC/26, Part II, para. 14 and INFCIRC/66/Rev. 2, Part IV, para. 80.

c/ NPT Safeguards Agreement.

d/ Denmark joined EURATOM on 1 January 1973 and has signed the Agreement with EURATOM and its non-nuclear-weapon member States; however, Agency safeguards are presently applied in this State under the NPT Safeguards Agreement which Denmark had concluded with the Agency prior to joining EURATOM.

e/ Pilot plant.