

ANNUAL REPORT

1 July 1972 - 30 June 1973

GC(XVII)/500

Printed by the
International Atomic Energy Agency
in Austria - July 1973



INTERNATIONAL ATOMIC ENERGY AGENCY

CONTENTS

| | <u>Paragraphs</u> | <u>Page</u> |
|---|-------------------|-------------|
| INTRODUCTION | 1 - 26 | 5 |
| THE AGENCY'S ACTIVITIES | 27 - 153 | 10 |
| Technical co-operation | 27 - 47 | 10 |
| Food and agriculture | 48 - 56 | 21 |
| Life sciences | 57 - 66 | 25 |
| Physical sciences | 67 - 92 | 28 |
| Nuclear technology | 93 - 112 | 33 |
| Nuclear safety and environmental protection | 113 - 125 | 40 |
| Information and technical services | 126 - 135 | 44 |
| Safeguarding peaceful nuclear activities | 136 - 153 | 47 |
| ADMINISTRATION | 154 - 173 | 58 |
| External relations and legal matters | 154 - 160 | 58 |
| Personnel | 161 - 164 | 59 |
| Finance | 165 - 173 | 61 |

ANNEXES

| | |
|---------|--|
| ANNEX A | FELLOWSHIPS OFFERED OR PROVIDED FREE OF CHARGE IN 1972 |
| ANNEX B | RESEARCH CONTRACTS |
| ANNEX C | CONFERENCES, SYMPOSIA AND SEMINARS HELD DURING THE PERIOD 1 JULY 1972-30 JUNE 1973 |
| ANNEX D | STATUS OF FINANCIAL CONTRIBUTIONS TO THE AGENCY ON 30 JUNE 1973 |
| ANNEX E | NUCLEAR INSTALLATIONS UNDER AGENCY SAFEGUARDS OR CONTAINING SAFEGUARDED MATERIAL UNDER AGREEMENTS APPROVED BY THE BOARD OF GOVERNORS |

List of abbreviations

| | |
|----------|---|
| Agency | International Atomic Energy Agency |
| AGRIS | Agricultural Information System |
| ECOSOC | Economic and Social Council of the United Nations |
| EURATOM | European Atomic Energy Community |
| FAO | Food and Agriculture Organization of the United Nations |
| IAEA | International Atomic Energy Agency |
| IBRD | International Bank for Reconstruction and Development |
| ILO | International Labour Organisation |
| IMCO | Inter-Governmental Maritime Consultative Organization |
| INIS | International Nuclear Information System |
| KEMA | Tot Keuring van Electrotechnische Materialen, Arnhem |
| MHD | Magnetohydrodynamic |
| NEA | Nuclear Energy Agency of the Organisation for Economic Co-operation and Development |
| NPT | Treaty on the Non-Proliferation of Nuclear Weapons |
| OPANAL | Organization for the Prohibition of Nuclear Weapons in Latin America |
| SAC | Scientific Advisory Committee |
| SIDA | Swedish International Development Authority |
| UNDP | United Nations Development Programme |
| UNDP(SF) | United Nations Development Programme (Special Fund component) |
| UNDP(TA) | United Nations Development Programme (Technical Assistance component) |
| UNEF | United Nations Environment Fund |
| UNEP | United Nations Environmental 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 |
| WMO | World Meteorological Organization |

 NOTE

All sums of money are expressed in United States dollars.

INTRODUCTION

General

1. During the twelve months covered by this report, as in 1971/72, the Agency gave special attention to work relating to the negotiation of safeguards agreements in connection with NPT, assistance to developing countries and the impact of nuclear energy on the environment.

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

2. By 30 June 1973, 95 non-nuclear-weapon States had signed NPT and 76 of them had ratified or acceded to it; of the latter, 37 had concluded the safeguards agreements with the Agency that are required by NPT, and 26 of these agreements had entered into force. The required agreements were thus in force in 34% of the non-nuclear-weapon States party to NPT. More detailed information is given in Table 15 below. Five new safeguards agreements outside the scope of NPT also entered into force during the last twelve months.

3. The Safeguards Agreement with EURATOM and the non-nuclear-weapon States members of EURATOM (Belgium, the Federal Republic of Germany, Italy, Luxembourg, the Netherlands) approved by the Agency's Board of Governors in Mexico City in September 1972, was signed in Brussels on 5 April 1973 by all concerned, as well as Denmark and Ireland, which joined EURATOM on 1 January 1973.

4. In regard to the offer of the United Kingdom of Great Britain and Northern Ireland and the United States of America to place certain of their nuclear activities under the Agency's safeguards, there have been further consultations and a draft agreement between the Agency and the United States is being discussed. Consultations on the United Kingdom offer are expected to resume in the second half of 1973 with a view to an agreement between the Agency, EURATOM and the United Kingdom.

5. Of the 18 States for which the Treaty for the Prohibition of Nuclear Weapons in Latin America (Tlatelolco Treaty) was in force on 30 June 1973, four had concluded the safeguards agreements required by it, consisting of comprehensive arrangements satisfying the requirements of both NPT and the Tlatelolco Treaty. [1] A co-operation agreement between the Agency and OPANAL was signed in Mexico City and entered into force on 3 October 1972.

6. The growth in safeguards work has made it necessary to adapt and standardize safeguards operations. The Agency is also developing further the safeguards procedures for all types of nuclear plant, including uranium enrichment plants, developing and installing improved equipment for measurement and surveillance and building up relations with a number of laboratories in various Member States for the analysis of nuclear material samples for safeguards purposes.

[1] In addition the Netherlands had concluded safeguards agreements for Surinam and the Netherlands Antilles to meet the requirements of NPT and Protocol I to the Tlatelolco Treaty.

Technical co-operation activities

7. The total resources available to the Agency for technical co-operation activities amount to an estimated 6.8 million dollars in 1973, compared with 6.2 million in 1972 and 5.4 million in 1971.
8. At the beginning of 1973 the Agency was executing nine large-scale projects for UNDP.

Nuclear energy and the environment

9. In accordance with the Board's decision of March 1972[2] the Agency has intensified its programme relating to the protection of the environment and, in particular, the safe management of nuclear waste. The additional activities outlined by the Director General at the sixteenth (1972) regular session of the General Conference in Mexico City, were subsequently commended by a group of experts and by SAC and formally endorsed by the Board in February 1973. To finance the launching of these activities in 1973 special contributions were given by Australia (\$5000), Finland (\$5000), France (\$5000), the Federal Republic of Germany (\$10 000), Japan (\$7941), South Africa (\$5000), Sweden (\$5000), the United Kingdom (not less than \$5000) and the United States (\$100 000).
10. Part of the impetus for the new work was given by the United Nations Conference on the Human Environment, which was held in Stockholm in June 1972. A conference in London in November 1972 adopted a Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. The Convention referred to the Agency as the competent body to define high-level radioactive matter which should not be dumped at sea, and also called upon the parties to take full account of the Agency's recommendations when issuing permits for dumping other radioactive matter.
11. In February 1973 the Board authorized the Director General to enter into arrangements with UNEP for the implementation of activities or projects relating to the impact of nuclear energy on the environment or the use of nuclear science techniques in environmental studies. The Agency has proposed seven projects to UNEP. Each of these relates to recommendations of the Stockholm Conference, chiefly regarding nuclear safety and environmental protection. It is expected that a joint IAEA/UNESCO project to extend the work of the International Laboratory of Marine Radioactivity, Monaco to include studies by nuclear techniques, of certain non-nuclear pollutants such as mercury, lead and insecticides, will be submitted to UNEP later this year. UNEP has indicated that it will be ready to discuss these projects in greater detail during the second part of this year. Until a detailed UNEP programme is drawn up and approved by its Governing Council in March 1974, it will not be possible to foresee what support UNEP can give to the Agency's environmental programmes.

Other technical work

12. By the end of 1972, 37 000 MW of nuclear generating plant was in operation throughout the world. In its annual report to the General Conference for 1968/69 the Board estimated that the world's installed nuclear capacity in 1980 would be between 300-350 000 MW. [3]

[2] See document GC(XVI)/480, para. 99.

[3] See document GC(XIII)/404, para. 64.

This estimate has fluctuated only to a small extent in the intervening years. The current forecast for 1980 is 315 000 MW. Of this a record 46 350 MW were ordered in 1972, bringing the total nuclear plant capacity built or on order to 226 500 MW. Thus if the 1980 estimate is to be reached, orders will have to be placed and construction begin on further plants of a capacity of at least 88 500 MW by the end of 1975.

13. An implication of the growth of nuclear power is that 1.5 million tons of new reserves of low-cost uranium should be found or confirmed in the next 15 years, i. e. about 1.5 times as much as the published existing reserves of low-cost uranium. Very large quantities will be needed annually in the late 1980s; however, by 2005 or 2010 the requirements may decline again due to the extensive use of breeders.

14. A detailed survey of the market for nuclear power in developing countries, which was launched in 1971/72 has now been completed in 14 of the countries concerned. [4]

15. The full scope of nuclear science literature is now covered by INIS. The number of items handled increased from about 8200 in 1970/71 to 12 007 in 1971/72, and 43 920 in 1972/73. FAO has requested the Agency's assistance in establishing a similar system - the Agricultural Information System (AGRIS) - covering sciences related to agriculture.

16. A detailed review was made in February 1973 by a group of specialists from Argentina, Hungary, the Philippines and the United States of the work of the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture. The specialists endorsed the Division's approach of concentrating on the solution of developing countries' problems and recommended that the present general balance of programme activities be maintained. Concern about the environment has stimulated interest in those programmes designed to reduce the need for chemical pesticides and fertilizers, such as the sterile-male technique for controlling insects, and studies of the best use of fertilizers and the breeding of disease-resistant plants.

The Board of Governors and the General Conference

17. On 1 June 1973 the amended version of Article VI, A-D of the Statute, which the General Conference approved in 1970, came into force. [5] As a result the size of the Board will be increased by about one third and considerably more developing Member States will be elected to the Board by the Conference.

18. The Director General will put before the Conference when it meets in September proposals for the necessary amendment of its Rules of Procedure to provide for this. He will also take the opportunity to make various suggestions designed to simplify the Conference's procedures, expedite its work and reduce somewhat the costs of its meetings.

Questions of particular interest to the United Nations

19. This report of the Board to the General Conference will also serve as the Agency's report both to the General Assembly of the United Nations and to ECOSOC. The Board wishes to draw attention to matters in which the General Assembly and ECOSOC have shown special interest, particularly those set out in General Assembly Resolution 2931 (XXVII).

[4] See paras 96 and 97 below, and document GC(XVII)/506.

[5] For details, see document INFCIRC/159/Rev. 3.

20. It is to be noted that the coming into force of the amended version of Article VI of the Statute meets a wish expressed in 1968 by the Conference of Non-Nuclear-Weapon States[6]. Other matters which that Conference dealt with are mentioned in paragraphs 126 to 130 below on INIS, and in paragraphs 93 to 112 on developments in nuclear technology.

21. A third international meeting of experts on nuclear explosions for peaceful purposes, which was the subject of General Assembly Resolution 2829 (XXVI), was held in November 1972 and a further meeting is planned for the end of 1973 to draw up detailed procedures for dealing with requests from Member States for assistance in nuclear explosions for peaceful purposes.

22. Reference has already been made to progress relating to NPT and in developing safeguards to cover nuclear material in enrichment plants on which subject the General Assembly adopted Resolutions 2825 (XXVI) and 2907 (XXVII).

23. As indicated in paragraph 11 above, the Agency has established close working links with UNEP and is seeking support from UNEF to finance certain activities. The only other significant inter-agency question which has arisen during the year was once again the division of responsibilities between the United Nations and the Agency in regard to prospecting for nuclear materials. The matter was discussed at the meeting of the Committee on Natural Resources of ECOSOC in New Delhi in February 1973. The Committee stressed the "extreme importance" of the Agency's work in this regard and agreed that ECOSOC Resolution 1550 (XLIX) "continued to provide a satisfactory basis for the division of responsibility between the United Nations and the IAEA".

Financial and administrative questions

24. The financial problem with which the Agency, like the other organizations of the United Nations system, is faced has been seriously aggravated by continuing inflation and realignment of international currency rates of exchange. The sharp and abrupt movements in the relative value of some major currencies have compounded the difficulties of accurate budgeting and have confronted the Board and the Director General with acute financial problems. The Board in June agreed to recommend to the General Conference a supplemental appropriation for 1973 enabling the Director General to incur obligations at a level higher than originally approved and a supplemental 1973 assessment on Members in the amount of \$1 250 000 to cover the portion of increased costs which cannot be met by economies.

25. In the meantime the Director General has taken several measures to reduce expenditures. Recruitment will be virtually suspended during the third quarter of 1973, expenditures on duty travel, temporary assistance, overtime, hire of consultants and purchase of equipment have been sharply curtailed. The practice of paying the cost of participation in many meetings of experts from developed Member States is being reviewed. The Agency will continue to carry out approved technical programmes as far as possible, but many of these will be affected by changes in the value of major currencies.

[6] See Official Records of the General Assembly, Twenty-third Session, document A/7277, Resolution H. V.

Note on the structure of the report

26. It should be noted that much of the work of the divisions responsible for other scientific and technical programmes consists of support for the technical assistance programme; in the case of work on the application of nuclear science to food and agriculture, for instance, it has been estimated that such support represents about one quarter of the work of the division concerned. To avoid repetition, however, all technical co-operation activities are covered in paragraphs 27 to 36 of this report. A comprehensive report on the Agency's technical co-operation work in 1972 is being submitted separately in document GC(XVIII)/INF/142.

THE AGENCY'S ACTIVITIES

TECHNICAL CO-OPERATION

General

27. In 1972 approximately 6.2 million dollars were available for technical assistance and training compared with about 5.4 million dollars in 1971. The resources available for the Agency's technical assistance programmes during the period 1963-1972 shown in Figure 1 below while the distribution of technical assistance by field of activity and region in 1972 is illustrated in Figure 2.

FIGURE 1
RESOURCES AVAILABLE FOR
AGENCY TECHNICAL ASSISTANCE PROGRAMMES: 1963-1972
(in thousands of dollars)

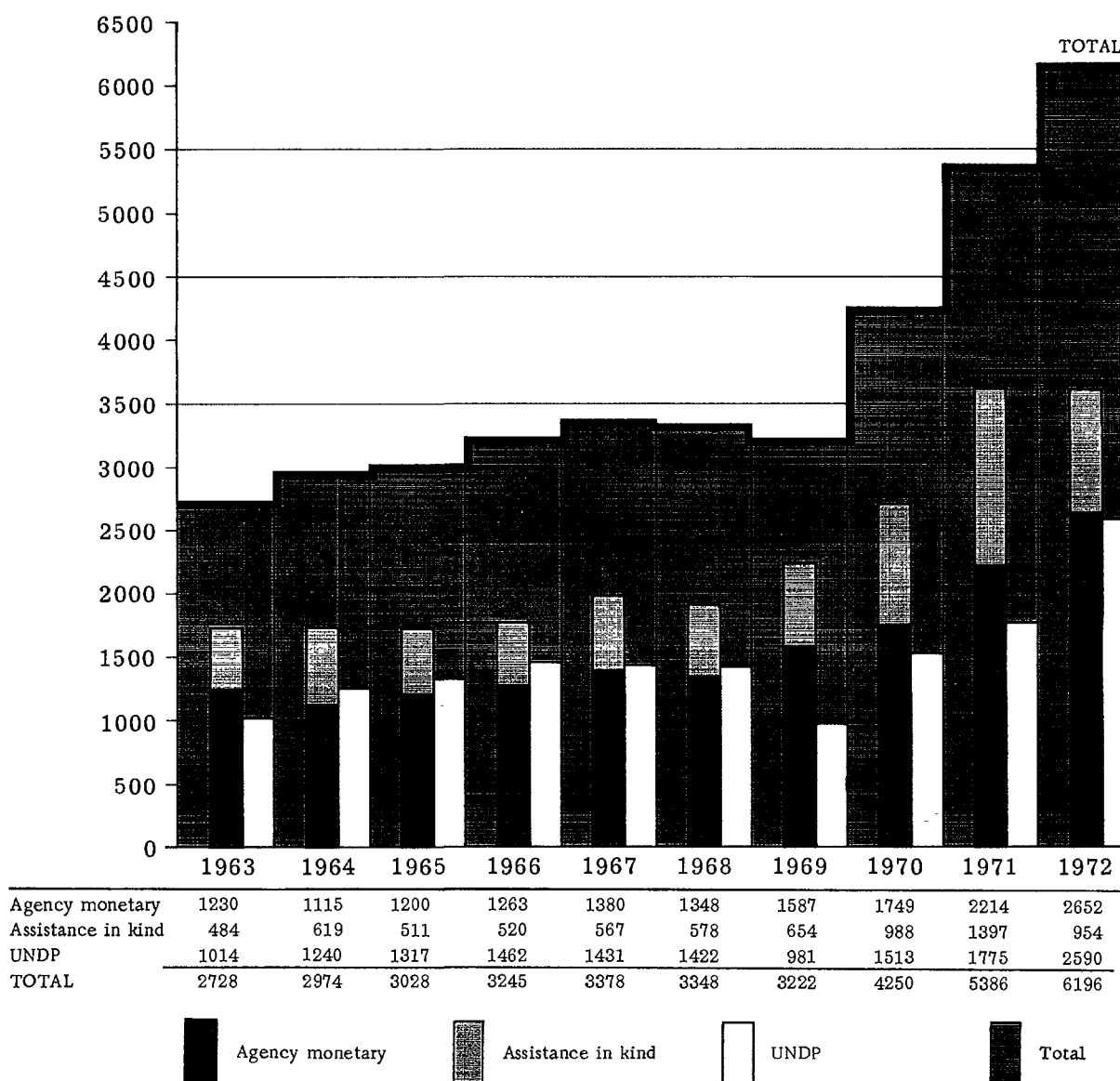
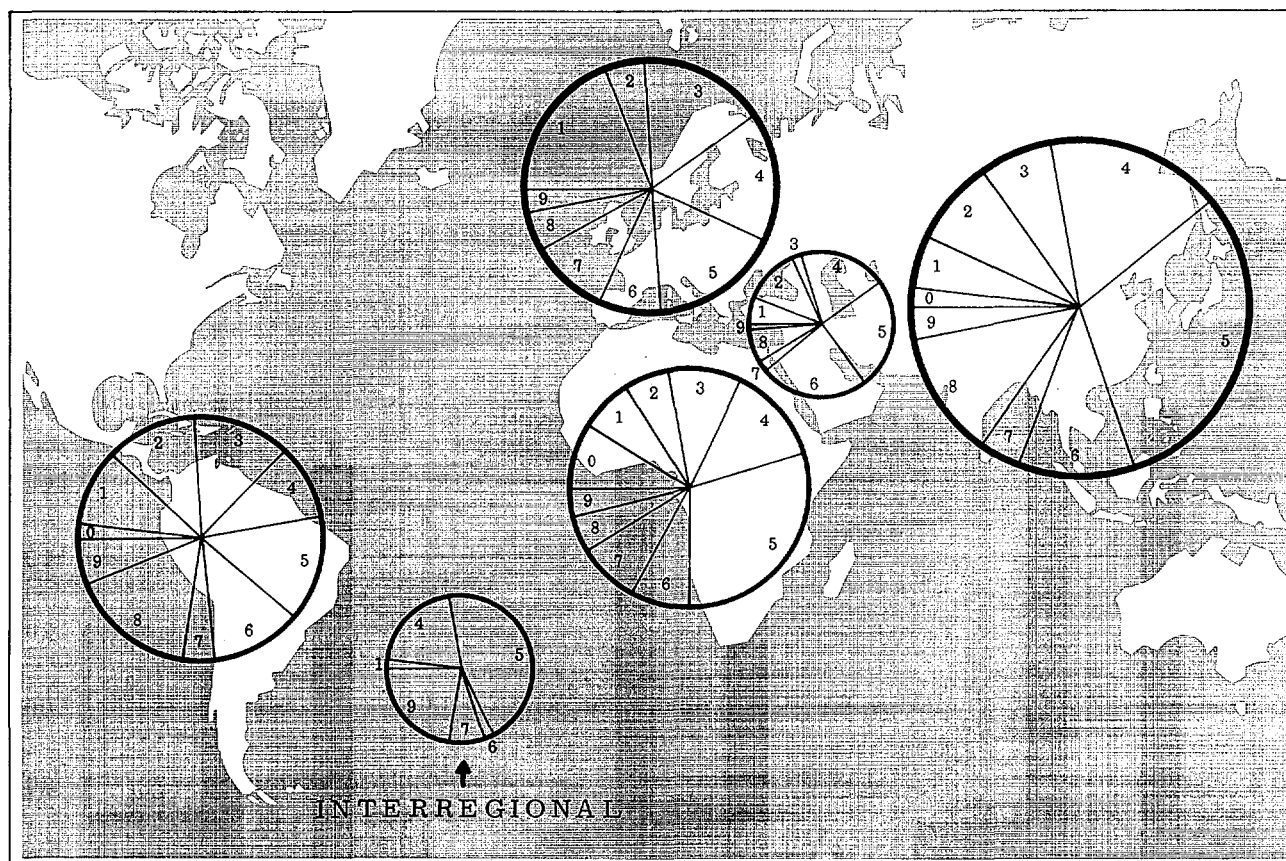


FIGURE 2

DISTRIBUTION OF TECHNICAL ASSISTANCE BY FIELD OF ACTIVITY AND REGION: 1972^{a/}

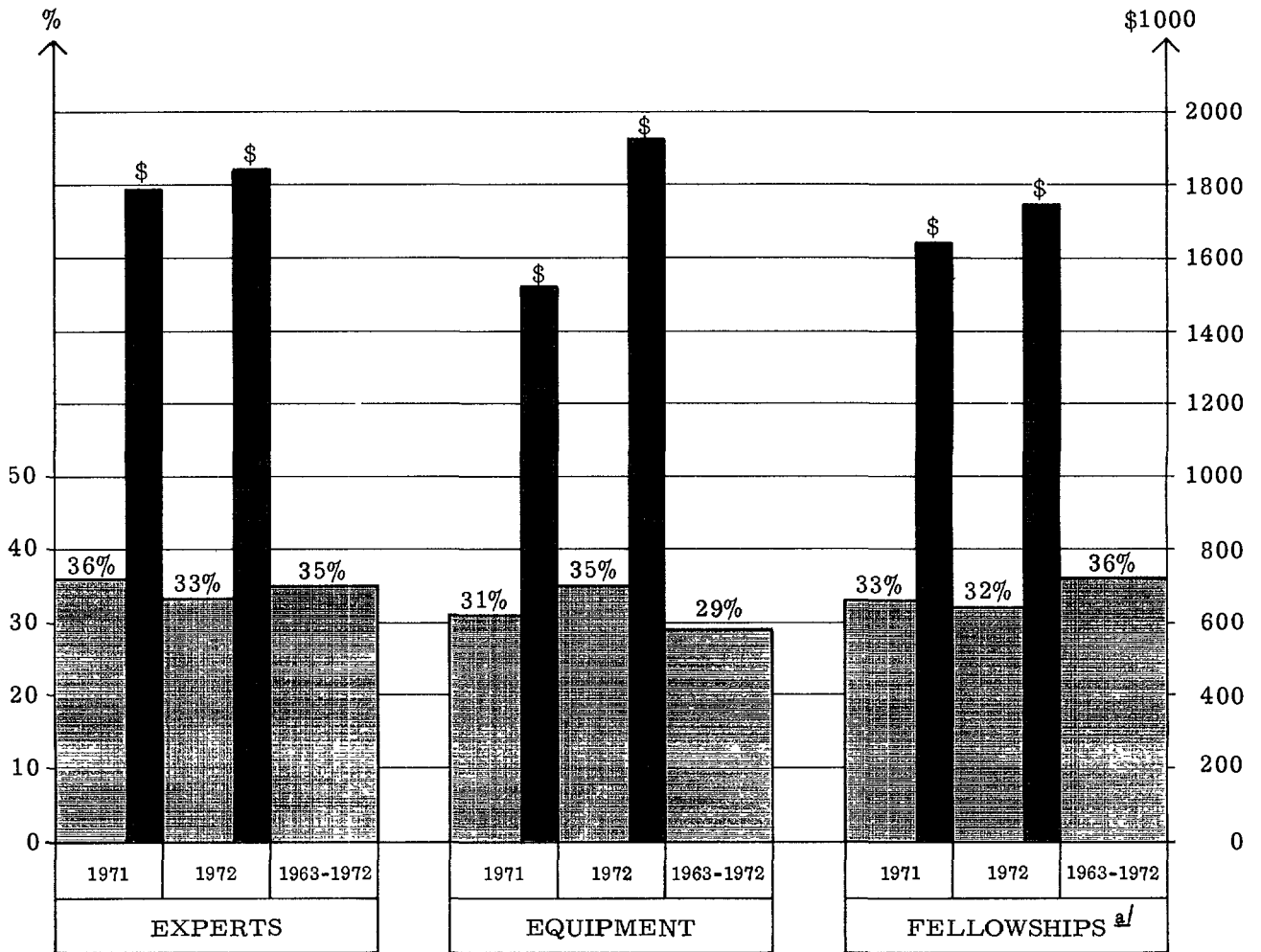
SUMMARY

| Field | Africa | Asia and the Far East | Europe | Latin America | Middle East | Inter-regional |
|---|--------|-----------------------|--------|---------------|-------------|----------------|
| | % | % | % | % | % | % |
| 0 - General atomic energy development | 9 | 2 | - | 2 | - | - |
| 1 - Nuclear physics | 7 | 5 | 19 | 10 | 6 | 2 |
| 2 - Nuclear chemistry | 6 | 8 | 5 | 12 | 12 | - |
| 3 - Prospecting, mining and processing of nuclear materials | 10 | 7 | 16 | 13 | 2 | - |
| 4 - Nuclear engineering and technology | 13 | 17 | 17 | 10 | 20 | 20 |
| 5 - Application of isotopes and radiation in agriculture | 30 | 31 | 17 | 14 | 25 | 46 |
| 6 - Application of isotopes and radiation in medicine | 8 | 11 | 8 | 12 | 22 | 2 |
| 7 - Application of isotopes and radiation in biology | 8 | 4 | 10 | 4 | 2 | 8 |
| 8 - Other fields of application of isotopes and radiation | 5 | 12 | 5 | 17 | 10 | - |
| 9 - Safety in nuclear energy | 4 | 3 | 3 | 6 | 1 | 22 |
| | 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.

28. The distribution of technical assistance by type of assistance during the last two years and during the decade 1963-1972 is illustrated in Figure 3.

FIGURE 3
DISTRIBUTION OF TECHNICAL ASSISTANCE BY TYPE OF ASSISTANCE
(1971, 1972 and 1963-1972)

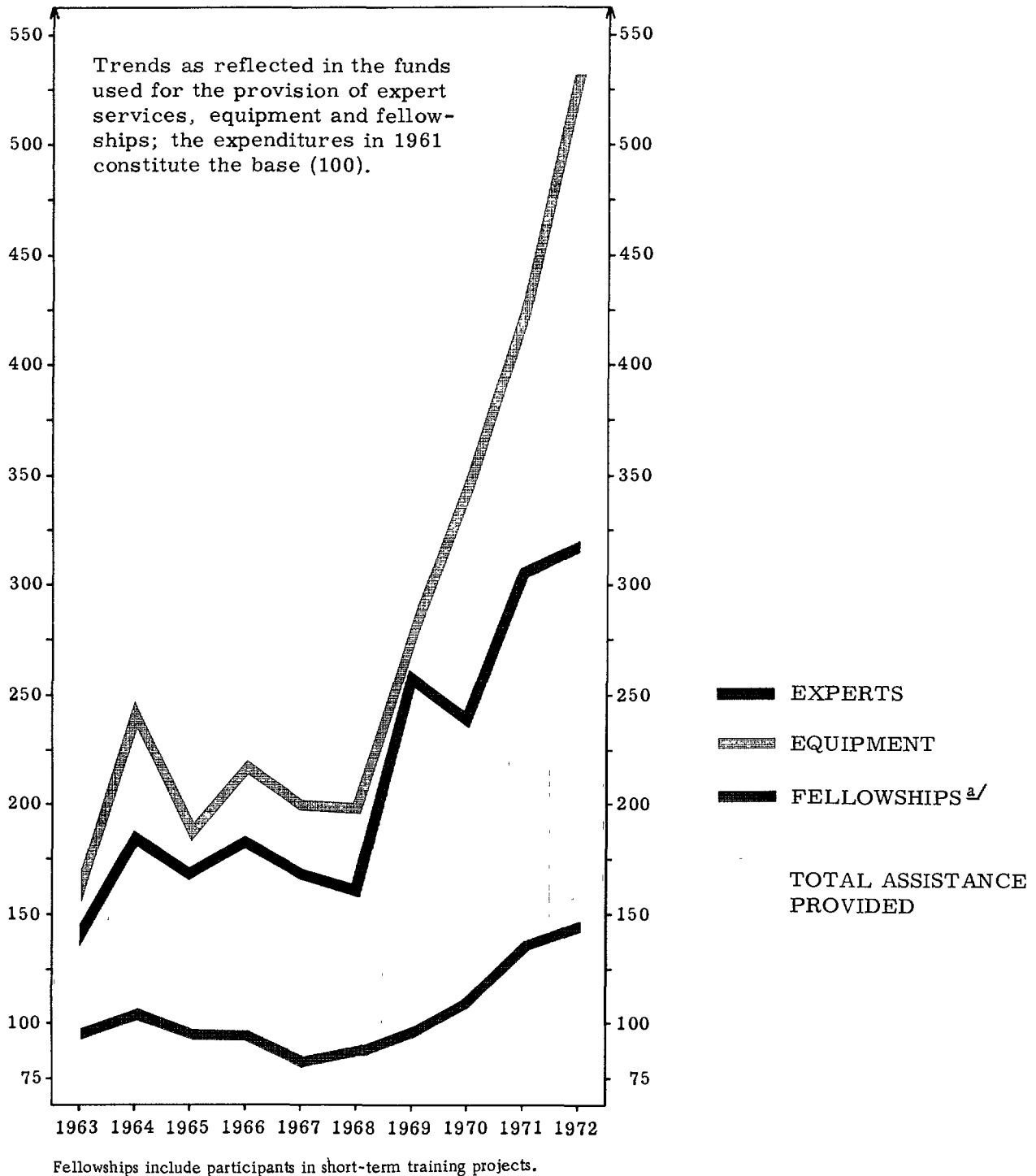


| Type | 1971 | | 1972 | | 1963-1972 | |
|---------------------------|------------|---------------|------------|---------------|------------|-----------------|
| | % | \$1000 | % | \$1000 | % | \$1000 |
| Experts | 36 | 1789.0 | 33 | 1840.2 | 35 | 12 423.5 |
| Equipment | 31 | 1525.0 | 35 | 1922.1 | 29 | 10 041.3 |
| Fellowships ^{a/} | 33 | 1631.1 | 32 | 1736.3 | 36 | 12 634.8 |
| Total | 100 | 4945.1 | 100 | 5498.6 | 100 | 35 099.6 |

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

29. 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



Training

30. A list of the fellowships made available to the Agency free of charge by Member States in 1972 is given in Annex A. Some of the "Type II" fellowship openings were carried over from a previous year's offer.

31. Table 1 below gives an analysis of the six training courses, four study tours (seminars) and the co-operative project that the Agency arranged in 13 countries from mid-1972 to mid-1973.

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 isotopes and radiation in forestry | Helsinki 5 June to 21 July 1972 | 18 | Regular programme and FAO |
| Study tour (seminar) on mass rearing of insects as related to the sterile-male technique | United States 12 June to 14 July 1972 | 22 | Regular programme |
| Co-operative project in neutron scattering, in the Asia and Far East region | Bangkok, Manila and Seoul 1 July to 19 September 1972 | 5 | Regular programme |
| Study tour on the use of isotopes and radiation in genetics and plant breeding | Soviet Union 4 July to 4 August 1972 | 29 | Regular programme |
| Interregional training course on the basic principles of isotope and radiation equipment used in soil research | Hanover, Federal Republic of Germany 19 July to 6 September 1972 | 21 | FAO and the Federal Republic of Germany |
| Interregional training course on the maintenance and repair of nuclear electronic equipment | Turin, Italy 28 August to 1 December 1972 | 14 | UNDP and regular programme |
| Interregional training course on the use of isotope tracer techniques for studying pesticide problems | Vienna 18 September to 13 October 1972 | 12 | SIDA |
| Regional training course on the use of isotopes and radiation for the development of industrially useful micro-organisms | Manila 23 October to 1 December 1972 | 19 | Regular programme |

| Project | Place and dates | Total number of participants | Source of funds |
|--|--|------------------------------|-------------------|
| Regional seminar on the application of nuclear techniques in agriculture | Bombay and New Delhi 2 to 20 April 1973 | 22 | UNDP |
| Study tour on waste management techniques and environmental protection | Czechoslovakia, Poland and the Soviet Union 7 May to 15 June 1973 | 25 | Regular programme |
| Regional advanced training course on radiological health and safety measures | Athens 4 to 22 June 1973 | 21 | UNDP |

UNDP projects

32. During the period covered by this report the large-scale nuclear survey in the Philippines, for which the Agency was the executing agency, was completed. This was a follow-up of an earlier (1964-66) UNDP study which indicated a long-term need for nuclear power in Luzon. The results of this feasibility study indicate that the introduction of the two unit nuclear station of around 600-MW output each into the combined power supply system of Luzon would be technically feasible and economically viable during the early 1980s. Two sites were examined and found suitable - Bagac and San Juan. The cost of two 600-MW units, including the land, was estimated at approximately \$400 million.

33. The large-scale UNDP projects being carried out by the Agency on 30 June 1973 are summarized in Table 2 below. A brief outline of the projects follows.

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 dollars) | UNDP contribution (in dollars) |
|---|---------------------------|--------------------------|--------------------------------------|--------------------------------|
| INDIA, Nuclear research in agriculture | 14 October 1968 | 5.0 | 2 661 700 | 1 737 800 |
| GREECE, Exploration for uranium in Central and Eastern Macedonia and Thrace ^{a/} | 18 May 1971 | 2.5 | 342 900 | 369 500 |

| Recipient country and title of the project | Start of field operations | Project duration (years) | Government contribution (in dollars) | UNDP contribution (in dollars) |
|---|---------------------------|--------------------------|--------------------------------------|--------------------------------|
| PAKISTAN, Detailed exploration of uranium and other radioactive occurrences in the Siwalik sandstones in the Dera Ghazi Khan District <u>a/</u> | 27 September 1971 | 2.0 | 700 500 | 464 400 |
| INDIA, Demonstration plant for irradiation sterilization of medical products | 26 May 1972 | 3.0 | 675 400 | 677 000 |
| BRAZIL, Development of agricultural production through the application of nuclear technology | 15 September 1972 | 5.0 | 5 273 000 | 941 610 |
| ROMANIA, Development of nuclear technology | 7 February 1973 | 2.5 | 8 443 200 | 1 304 300 |
| ARGENTINA, National centre for non-destructive testing and quality control <u>b/</u> | 23 March 1973 | 3.0 | 1 165 400 | 623 100 |
| CHILE, National nuclear energy centre | 1973 | 3.0 | 1 731 000 | 735 700 |
| HUNGARY, Irradiation sterilization of medical products | 1973 | 4.0 | 4 154 000 | 605 200 |

a/ Implemented in association with the United Nations.

b/ Implemented in association with UNIDO.

Nuclear research in agriculture in India

34. A nuclear research laboratory is being established at the Agricultural Research Institute in New Delhi, which will also extend research and training facilities to three other centres, with the aim of reaching a 40% increase in grain production in the next five years. Expert assistance has also been given to the Indian Veterinary Research Institute and the National Dairy Research Institute in nuclear applications in animal health and the development of vaccines against various parasitic diseases (lung-worm in sheep in particular), and to improve the nutrition of buffalo and cattle by increasing the utilization of ready-available feedstuffs and agro-industrial by-products. Some findings from this assistance have already resulted in field application, e.g. experiments of vaccination against lung-worm in Kashmir

have resulted in an increase of weight of 3-4 kg per lamb per season, and the new techniques of molasses-urea feeding have been used in respect of as many as 400 000 animals to avert the effects of a long, severe drought in India.

Exploration for uranium in Central and Eastern Macedonia and Thrace in Greece

35. This project is to assist the Government in locating and defining areas of significant uranium potential. Basic data related to the number, extent and significance of uranium and other radioactive occurrence is being determined. The information will enable the Government to plan in detail its subsequent mineral development programme. The results obtained have been encouraging, and it is expected that a request will be submitted to UNDP at the conclusion of the current field season to authorize a continuation of activities under a second phase of the project.

Detailed exploration of uranium and other radioactive occurrences in the Siwalik sandstones in the Dera Ghazi Khan District in Pakistan

36. In this project the Government is being assisted in determining the extent and the economic potential of uranium occurrences in the Siwalik sandstones. Exploration findings have been sufficiently encouraging to justify an extension of the duration of field operations, and this has been requested by the Pakistan Government.

Demonstration plant for irradiation sterilization of medical products in India

37. This project is to establish a cobalt-60 irradiation facility near the Bhabha Atomic Research Centre in Bombay. The radiation sterilization plant will be commissioned by the end of 1974 and will provide an initial annual capacity for 100 000 cubic feet of finished medical products. The most important items to be sterilized by the irradiation facility will be surgical sutures, disposable syringes, needles, cotton products and bandages. This plant is a pilot project for similar facilities to be set up elsewhere in India. Furthermore, the experience gained will prove useful to the Agency in implementing similar projects in Egypt, Hungary and the Republic of Korea.

The application of nuclear technology in agriculture in Brazil

38. This project is to assist the Government in expanding the application of nuclear technology in agriculture, particularly in plant breeding and nutrition, in achieving greater effectiveness in the use of fertilizers, and in the control of pests and diseases. Training and research activities are being carried out at the Centre of Nuclear Energy in Agriculture in Piracicaba. The aim of the project is to increase and improve the country's agricultural production.

Development of nuclear technology in Romania

39. The Institute of Nuclear Technology in Romania will be expanded and strengthened, and will work exclusively for the nuclear power industry in the country, where 1000 MW of electricity generated from nuclear power is scheduled to be available in 1980. Technological knowledge, specific to the reactor components of nuclear power plants is required to enable the national industry to play a significant role in the Romanian nuclear energy programme, and the Institute will provide this training. The long-range objective of this project is to assist the Government in developing the necessary technology for manufacturing some reactor components for the construction of nuclear power plants.

National centre for non-destructive testing and quality control in Argentina

40. This project will establish permanent facilities to provide a non-destructive testing and quality control service to Argentine industry. Originally designed to test fuels to be used in the country's nuclear reactors, the scope of the centre's work has been extended to include the testing of metals, plastics and alloys. It is hoped that the Buenos Aires project will be a pilot scheme for other Latin American countries, whose representatives are becoming acquainted with the centre's work through attendance at a training course.

National nuclear energy centre in Chile

41. This is to assist in the establishment of a national institution near Santiago for the application of nuclear research in agriculture, industry and medicine. A project manager has been appointed, and a project document is being drawn up.

Irradiation sterilization of medical products in Hungary

42. This project, which is similar to the one mentioned in paragraph 37 above, will provide for the sterilization of medical products by means of a cobalt-60 irradiation facility.

General trends

43. The increasing emphasis on nuclear technology reflected in the requests for assistance is in turn a reflection of the needs for increased energy in developing Member States. At present, eight Member States receiving technical assistance have nuclear power stations in operation or under construction. Many others, foreseeing the shortage of conventional power sources in the next two decades, have carried out or are carrying out feasibility studies. The whole process of the introduction of nuclear power requires the State concerned to start planning at least eight to ten years before a nuclear plant is to go into operation, and in preparation for this work the technical assistance programme is being increasingly utilized by Member States for the essential training of personnel.

The Agency's regular programme

44. The status of voluntary contributions to the General Fund from which the Agency's regular programme of technical assistance is financed, is shown in Table 3 below. Cash contributions pledged to the General Fund for 1973 exceeded 90% of the target, the highest percentage achieved so far.

45. However, the financial situation with which all multilateral aid programmes are confronted is giving cause for concern, and the Agency's regular programme of technical assistance is no exception. While there has been a most welcome increase in the percentage met of the \$3 million target for voluntary contributions to the General Fund for 1973; it is to be noted that most of the increase is offset by inflation.

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 \$ | Number of Members pledging | Percentage of Members pledging |
| 1962 | 2.0 | 1 380 470 | 69.0 | 619 530 | 44 of 80 | 55.0 |
| 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 | 2 142 675 | 85.7 | 357 325 | 71 of 102 | 69.6 |
| 1972 | 3.0 | 2 492 105 | 83.1 | 507 895 | 70 of 103 | 68.0 |
| 1973 ^{a/} | 3.0 | 2 742 604 | 91.4 | 257 396 | 58 of 102 | 56.9 |

^{a/} As at 30 June 1973.

46. As shown in Table 4 below, the value of approved requests for experts and equipment under the Agency's regular programme increased from \$2 123 600 in 1972 to \$2 279 000 in 1973. This slight increase may partly reflect price increases, estimated by UNDP at 6-7% per annum in recent years. The value of the assistance approved for 1973 is 7.3% higher than for 1972. The cost to the Agency of providing expert services has increased by 55% since 1962, the cost of equipment is now rising at an estimated rate of 12% per year, and the cost of fellowship training has increased by over 80% in the last twelve years.

Table 4
Experts and equipment: 1969-1973

| 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 |

47. Other developments in the regular programme were:

- (a) The share of resources allocated to equipment rose from 24% in 1969 to 29% in 1971, and to 31% in 1973. This trend is largely due to contributions of equipment from France, the Federal Republic of Germany and the United States;
- (b) Projects covering the provision of expert services or equipment, or both, were approved for 46 Member States in 1969, for 52 in 1971 and 53 in 1973; and
- (c) In 1973, 34 requests were found to be technically sound but could not be met because of lack of funds (compared with 47 in 1969 and 27 in 1971). These requests were brought to the attention of technically advanced Member States; the Agency is not aware of the extent (if any) to which the requests were met.

FOOD AND AGRICULTURE

Summary

48. The main purpose of the joint FAO/Agency programme in food and agriculture is to make those nuclear techniques available to developing countries that can effectively contribute to increasing productivity in agriculture. A large proportion of the work is carried out within co-ordinated research programmes on selected, well-defined problems. Table 5 below summarizes the research programmes at present supported.

Table 5
Research contracts and agreements on food and agriculture

| Subject | Countries in which research is carried out with Agency support | Cost to the Agency in 1972 (in dollars) |
|---|--|---|
| Improved use of fertilizer in rice growing | Bangladesh, Burma, India, Indonesia, Republic of Korea, Philippines, Sri Lanka, Thailand, Viet-Nam | 14 100 |
| Fertilizer use for grain legumes | Brazil ^{a/} , Egypt, Ghana, Greece, Hungary, Peru, Romania, Senegal, Sri Lanka, United Kingdom (2 ^{a/}), United States ^{a/} | 20 000 |
| Water use efficiency studies | Belgium ^{a/} , Brazil ^{a/} , Bulgaria, Chile, Cyprus, France (2 ^{a/}), Israel, Japan ^{a/} , Madagascar, Nigeria, Thailand | 23 885 |
| 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, Sweden ^{a/} , Tanzania, Thailand, Uganda, United Kingdom, Yugoslavia | 48 430 |
| 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 | 27 850 |
| Induced rice mutants | Egypt, India, Indonesia, Republic of Korea, Pakistan, Sri Lanka, Thailand, Viet-Nam | 27 500 |
| Improvement of mutation breeding techniques | Australia ^{a/} , Belgium ^{a/} , Czechoslovakia ^{a/} , France ^{a/} , India ^{a/} , Israel ^{a/} , Japan ^{a/} , Soviet Union ^{a/} , Sweden ^{a/} , United States (2 ^{a/}) | - |
| Improvement of vegetatively propagated and tree crops | Israel, Japan (2), Philippines, Poland | 15 300 |

| Subject | Countries in which research is carried out with Agency support | Cost to the Agency in 1972 (in dollars) |
|---|---|---|
| Studies on non-protein nitrogen in ruminants | Australia, Belgium ^{a/} , Czechoslovakia ^{a/} , Egypt, France ^{a/} , Federal Republic of Germany (2 ^{a/}), Hungary, India ^{a/} , United Kingdom ^{a/} , United States ^{a/} | 8 000 |
| Fruit-fly control by the sterile-male technique | Egypt, Federal Republic of Germany ^{a/} , Greece (2), Israel, Mexico, Netherlands, Portugal, Peru, Philippines, Spain, Switzerland ^{a/} , Yugoslavia | 28 000 |
| Control of animal insect pests by the sterile-male technique | Belgium ^{a/} , Federal Republic of Germany ^{a/} , Israel ^{a/} , Kenya, Republic of Korea, United Kingdom ^{a/} | 3 000 |
| Ecology and behaviour of the <i>Heliothis</i> complex | Argentina, Colombia, Mexico, United States (4 ^{a/}), Venezuela | 10 000 |
| Control of lepidopterous insects by the sterile-male technique | Austria (2), Czechoslovakia, Hungary, Poland, Romania, United States ^{a/} , Yugoslavia | 20 000 |
| Fate and significance of foreign substances in food | Canada ^{a/} , Federal Republic of Germany (2 ^{a/}), Ghana, India, Israel ^{a/} , Japan ^{a/} , Pakistan, Sweden ^{a/} , United Kingdom (4 ^{a/}), Venezuela ^{a/} | 9 000 |
| Fate and significance of foreign substances in the agricultural environment | Brazil, Canada ^{a/} , Finland, Federal Republic of Germany (2 ^{a/}), Hungary ^{a/} , India, Mexico, Netherlands ^{a/} , Philippines, Turkey, Uganda, United Kingdom (3 ^{a/}), United States (4 ^{a/}), Yugoslavia ^{a/} | 18 000 |
| Preservation of fruits, vegetables and fish | Argentina, Belgium, Hungary, India, Iraq, Italy ^{a/} , Republic of Korea, Mexico, Nigeria, Philippines, Thailand | 39 500 |
| Control of harmful organisms in food | Bangladesh, Indonesia, Pakistan, Thailand | 17 350 |

^{a/} Cost-free research agreement.

49. During the period covered by the report, meetings of scientists working in the various co-ordinated programmes were held on the following subjects:

- (a) The use of nuclear techniques in wheat fertilization studies (Vienna, July 1972);
- (b) Improvement of mutation breeding techniques (Bari, Italy, October 1972), in co-operation with the Conference on Mutation and Polyploidy of the European Association for Research on Plant Breeding;
- (c) The use of isotopes and radiation in relation to control of rice insects (Bangkok, October 1972);
- (d) Isotope tracer-aided studies of the fate and significance of foreign substances in food and the agricultural environment (Ispra, Italy, October/November 1972);
- (e) The use of isotopes in fertilizer efficiency studies in grain legumes (Vienna, February 1973);
- (f) The use of isotopes in rice production studies (Bangkok, March 1973);
- (g) The use of radiation-induced mutations in rice breeding and production (New Delhi, March 1973); and
- (h) Induced mutations for disease resistance in crop plants (Novi Sad, Yugoslavia, May 1973).

50. Panels were convened in Vienna to consider the following topics:

- (a) Mutation breeding of vegetatively propagated and perennial crops;
- (b) The practical use of the sterile-male technique for insect control;
- (c) The use of isotopes in studies of nitrogen transport and assimilation in leguminous and cereal crop plants;
- (d) Disease prevention in mass rearing of insects for the sterile-male technique;
- (e) Isotopic tracer-aided studies of the fate and significance of agrochemical residues in soil, with particular reference to nitrates; and
- (f) Improving food quality by irradiation.

51. A panel held in Jakarta in October 1972 discussed the application of tracer techniques in tropical animal production studies. Another panel meeting in Bombay in November 1972 considered the application of food irradiation in developing countries. Analytical screening methods for seed protein content and quality were discussed at a panel in Svalöy, Sweden, in January 1973, under the auspices of the project on plant protein improvement, jointly carried out by the Agency, FAO and the Federal German Society for Radiation and Environmental Research.

52. A symposium held in Greece dealt with the use of isotopes in studies of the physiology of domestic animals with special reference to hot climates, and another symposium in India considered the various aspects of radiation preservation of food.

New trends

53. Concern about the environment has stimulated interest in many joint FAO/Agency programmes. Isotopic tracers are valuable tools for following and studying the effects of residues of pesticides, such as DDT and other foreign chemicals in the food chain. Radiation sterilization of insects can provide the means to control individual species without harm to other insects or other forms of life. The relevant programmes have therefore been expanded and there has been an increasing number of calls for advice on the use of the sterile-male technique, sometimes as part of a broader programme of control and sometimes where total eradication may be feasible. Similar reasons have led FAO and the Agency to begin a co-ordinated research programme for inducing greater disease resistance in crop plants by mutation breeding. Earlier programmes on the best use of nitrogen and phosphorus fertilizers have also been expanded in order to study means of reducing the pollution that results from excessive run-off of fertilizers into lakes and streams.

54. The work on the improvement of seed proteins has been expanded to include studies on soil fertility with grain legumes. Work on animal nutrition and health consisted mainly of using nitrogen-15 in studies of more efficient use of non-protein nitrogen, such as urea in ruminant feeding.

55. The success reported last year in using radiation-attenuated vaccines against lung-worm in sheep [7] has stimulated a large field programme and the development of radiation vaccines against other important animal parasites, such as those causing poultry disease. Under a technical assistance field programme in Fanar, Lebanon, significant progress has been made in the use of radiation-attenuated vaccines in attempts to control coccidiosis, one of the most serious diseases of poultry.

56. The large-scale project on nuclear research in agriculture in India [8], designed to improve the nutrition of cattle, water buffalo and sheep by using locally available protein sources, has shown that a simplified molasses urea liquid diet can be used as a complete diet.

[7] See document GC(XVI)/480, para. 39.

[8] See also para. 34 above.

LIFE SCIENCES

Dosimetry

57. As part of the current programme of support for research in dosimetry, research is being carried out under 14 contracts in Austria, Belgium, Bulgaria, Denmark, the Federal Republic of Germany, Iran, Israel, Poland, Romania, Switzerland, the United Kingdom, the United States and Yugoslavia. This includes cost-free research agreements on biophysical aspects of radiation quality and on computer applications in clinical dosimetry, the latter as part of a co-ordinated programme. The cost to the Agency for these contracts was \$27 245 in 1972.

58. Since 1966 the Agency has been distributing calibrated dosimeters to hospitals, clinics and research institutes in Member States for checking the radiation dose given by their cobalt sources in cancer treatment. The dosimeters are prepared and evaluated in the Agency's Laboratory and distributed by WHO. [9] WHO is subsidizing this service which is now being provided to about 120 institutes per year.

59. Services relating to the intercomparison of absorbed dose measurements have been provided on request to institutions in Czechoslovakia and Hungary.

60. Other activities undertaken during the period under review included:

- (a) A panel meeting to discuss fast neutron dosimetry held in Vienna in November 1972; and
- (b) A symposium on neutron monitoring for radiation protection in Vienna in December 1972.

Medical applications

61. The current programme of support for research on applications of radioisotopes in medicine is summarized in Table 6 below. All programmes were started in 1969 and are being continued.

Table 6

Research contracts on radioisotope applications
in medicine

| Subject | Countries in which research is carried out with Agency support | Cost to the Agency in 1972 (in dollars) |
|---|---|---|
| Whole-body counting techniques and their applications | Argentina ^a /, Romania ^a /, Sweden ^a / | |

[9] See document GC(XVI)/480, para. 49.

| Subject | Countries in which research is carried out with Agency support | Cost to the Agency in 1972 (in dollars) |
|---|--|---|
| Studies of iron metabolism | Bangladesh, India, Jamaica, Lebanon, Mexico, South Africa, Sri Lanka, Sudan, Sweden ^{a/} , Turkey, United States | 24 150 |
| Radioactivation techniques in studies of trace elements and mineral metabolism in man | Argentina, Bulgaria, Federal Republic of Germany ^{a/} , Greece ^{a/} , United Kingdom (1+1 ^{a/}), United States ^{a/} | 11 625 |
| In vitro assay techniques and their applications | Argentina (2), Bulgaria, Chile, Czechoslovakia, Ecuador (2), Greece (2), Iran, Iraq, Republic of Korea, Nigeria (3), Peru, Romania, Turkey, Uganda, Zambia | 40 400 |
| Immunological studies of communicable diseases | Bulgaria, India, Jamaica, Nigeria, Peru, Switzerland, United States, Yugoslavia | 17 650 |
| Scintigraphy | Argentina, Belgium ^{a/} , Colombia, Czechoslovakia, Ecuador, France ^{a/} , Federal Republic of Germany (3 ^{a/}), India (2), Japan ^{a/} , Mexico, Poland ^{a/} , Romania, Sweden (2 ^{a/}), United Kingdom (4 ^{a/}), United States (5 ^{a/}), Uruguay (1+1 ^{a/}) | 28 500 |
| Cardiovascular studies | Argentina, Hungary, Israel, Sudan | 5 500 |

^{a/} Cost-free research agreement.

62. The following activities were also undertaken during the period under review:

- (a) A panel meeting to discuss the standardization of radioimmunoassay procedures, held in Vienna in July 1972; and
- (b) A symposium on medical radioisotope scintigraphy, in Monte Carlo in October 1972.

Radiation biology

63. The current programme of support for research in radiation biology is summarized in the following table:

Table 7

Research contracts on radiation biology

| Subject | Countries in which research is carried out with Agency support | Cost to the Agency in 1972 (in dollars) |
|--|---|---|
| Sterilization of biomedical products and biological tissues | Czechoslovakia, Denmark (1+1 ^{a/}), Greece, Hungary, Poland, United Kingdom | 9 000 |
| Radiation microbiology | Austria (1+1 ^{a/}), Czechoslovakia, France (1+1 ^{a/}), Greece, India, Malaysia, Nigeria, Philippines, Singapore, United Kingdom | 31 500 |
| Attenuation of toxins and infective agents for preparation of vaccines | Argentina, Belgium, Ethiopia, Czechoslovakia, Iraq, United States (2 ^{a/}), Yugoslavia ^{a/} | 10 400 |
| Radiation biology of neutrons and heavy particles | Argentina, Austria, Netherlands | 10 500 |
| Environmental radiation biology | Austria (2+1 ^{a/}), India ^{a/} , Nigeria | 2 000 |
| Basic problems in radiation biology | Chile, Israel ^{a/} , Republic of Korea, Poland, Romania, Turkey | 10 500 |

^{a/} Cost-free research agreement.

64. In connection with the first contract listed in the table above, a working group was jointly convened with WHO to revise part of the recommended code of practice for radio-sterilization of medical products.

65. The emphasis of work under the third programme listed above has been shifted from the radiation attenuation of snake venoms to the use of nuclear techniques in the preparation of vaccines against human parasitic diseases, giving priority to African trypanosomiasis and malaria but not excluding other protozoan and helminthic infections important to public health. A co-ordinated research programme on this subject is being developed in co-operation with WHO.

66. The following activities were also undertaken during the period under review:

- (a) A panel meeting to discuss radiation effects on population dynamics in ecosystems, held in Reykjavik in October 1972; and
- (b) A panel meeting to discuss the modification of radiosensitivity in biological systems in Stockholm in June 1973.

PHYSICAL SCIENCES

Physics

67. The main objectives of the Agency's programme on physics remain the same as last year. Within the current programme of support for research in physics, research is being carried out under nine contracts in Brazil, Bulgaria, Greece, Israel, Netherlands, Poland, Romania, the Soviet Union and Yugoslavia. The cost to the Agency for these contracts amounted to \$26 500 in 1972.

68. The Agency provides assistance to many smaller nuclear centres through the research contract and technical assistance programmes, with emphasis on the utilization of low-energy accelerators and the development of various new nuclear techniques.

69. Other activities undertaken included:

- (a) Discussions with a number of experts on the Agency's role in fusion reactor development at the International Fusion Research Council Meeting, at Grenoble in August 1972; consultants meetings in Grenoble in October 1972 and in Vienna in December 1972;
- (b) A panel meeting on charged-particle-induced radiative capture, held at Vienna in October 1972, which discussed the many possibilities for the study of nuclear structure and reaction mechanisms with low-energy accelerators, as well as some recent important applications in charged-particle prompt activation analysis and in the study of crystals; and
- (c) A joint Agency/NEA International Liaison Group on thermionic electrical power generation, which met in Vienna in March 1973.

Nuclear data

70. The Agency and the other three international neutron data centres (Brookhaven, Obninsk and Saclay/NEA) continued their exchange of experimental data, which is compiled on magnetic tape. This exchange, known as EXFOR (exchange format) has increased from 304 data sets in 1970, to 1453 in 1971 and 2451 in 1972. In the last year 42 Member States participated in this exchange.

71. The scope of the compilation has been expanded to cover fission product yields and fission spectrum data. For the first time the Agency distributed evaluated standard reference data which are important for nuclear engineering.

72. The Agency published reports which contain lists of requests from 15 Member States for measurements of nuclear data of importance to reactor technology, fusion technology and safeguards. Targets and samples for nuclear data experiments have been procured for six Member States.

73. A panel on neutron standard reference data was held in Vienna in November 1972 and a symposium on applications of nuclear data in science and technology in Paris in March 1973.

Chemistry and industrial applications

Chemistry

74. The main activities under the Agency's programme on chemistry included:
- (a) A panel on the behaviour and chemical state of fission products in irradiated fuels, which was held in Vienna in August 1972. It was recommended that the Agency consider arranging an international comparison of analytical techniques used to predict radiation effects in fuel materials in reactors; and
 - (b) A symposium on new developments in radiopharmaceuticals and labelled compounds, which was held at Copenhagen in March 1973.
75. Work in the co-ordinated research programme on rapid methods for the quality control of radiopharmaceuticals has continued and several consultants' group meetings relating to chemistry were held during the year. A research co-ordination meeting on nuclear methods for detection and analysis of trace materials was also held, and research contracts on this subject were concluded with India, Indonesia, the Republic of Korea, the Philippines and Thailand, and research agreements with the United Kingdom and the United States.

Industrial applications

76. In co-operation with UNDP, the Agency has given advice in planning two large-scale projects on the industrial applications of ionizing radiation in Egypt and the Republic of Korea. The sterilization of medical products and electron-beam processing will be the main activities of these projects. [10]
77. Other activities concerned with industry include the following:
- (a) The Agency supported research work on radiation processing to produce wood-plastics in Ecuador and Mexico;
 - (b) A symposium on the use of nuclear techniques in the basic metal industries was held at Helsinki in August 1972 to review the most recent developments in this field;
 - (c) A consultants' group on the use of high-level radiation in the treatment of sewage and industrial waste was held at Vienna in February/March 1973 to examine the potential use of ionizing radiation for processing water and wastes; and
 - (d) A co-ordinated research programme on nuclear techniques in geochemical-geobotanical prospecting for minerals, begun in 1970, was continued. The programme involves research contracts with Czechoslovakia, Indonesia, the Philippines and Romania, and research agreements with the United Kingdom and the United States.

[10] See also para. 37 above.

Isotope hydrology

78. The main objectives of the Agency's programme in isotope hydrology are to encourage the use of isotope techniques as an additional tool for hydrological investigations, and to promote the refinement of existing methods and the development of new techniques.

79. The principal effort in research has been through the research contract programme. The Agency has also supported studies of certain aspects of carbon-14 analyses of ground water and has made an evaluation of the results of a co-ordinated programme to study the isotopic content of ground water and has developed models for the interpretation of isotope data.

80. The current programme of support for research in isotope hydrology provides for research under twelve contracts in the following countries: Chile, Cyprus, Denmark, Egypt, France, Hungary, Iceland, Indonesia, Netherlands, Poland, South Africa and Turkey. The cost to the Agency for these contracts amounted to \$51 450 in 1972.

81. The Working Group of the International Hydrological Decade on Nuclear Techniques, which met in Vienna in July 1972, discussed the application of tracer techniques to water pollution problems. A panel on interpretation of isotope data in hydrology met in Vienna in March 1973 and considered the potential application to hydrological problems of the distribution of ^{234}U and ^{238}U isotopes occurring naturally in ground water.

82. Table 8 below summarizes the field projects in isotope hydrology.

Table 8

Isotope hydrology: field projects

| Type of project | Number |
|---|--------|
| Regular programme of the Agency | 9 |
| UNDP | 4 |
| Sub-contractual services in isotope hydrology for UNDP large-scale projects | 7 |
| Fellowships | 8 |

83. During the period covered by this report isotope hydrological studies have been completed in UNDP large-scale projects in Chad, Lebanon, Senegal and Surinam.

Laboratories

Seibersdorf Laboratory

84. The Agency's Laboratory at Seibersdorf has helped to adapt, design and construct safeguards surveillance equipment. There has also been an increase in the number of routine analyses of uranium isotopic and plutonium content of samples taken for safeguards purposes.

85. In regard to the sterile-insect release technique, there has been progress in the rearing of tsetse flies on membranes without the use of live animals. Other species under study are the olive and stable flies and Lepidoptera. With the Agency's advice and help technicians in Cyprus, Israel and Peru have started relatively large-scale field release of sterilized Mediterranean fruit flies.

86. The Laboratory has provided "in service" training for fellows from Ethiopia, Indonesia, Iran, Israel, the Republic of Korea, Mexico, Turkey and Uganda.

International Laboratory of Marine Radioactivity in Monaco

87. The main continuing programme of the Monaco Laboratory is to compare and calibrate the methodology used by various national and other laboratories to measure radionuclides in marine samples. Work has been completed on measuring fission product radionuclides in moderately contaminated seaweed samples. Several of the co-operating laboratories have also made determinations of the plutonium content of the distributed seaweed samples as well as of sea-water samples collected from the same area as the seaweed specimen. The laboratory will now distribute sediments, clams, open ocean Atlantic sea-water of low radioactivity and a sample of moderately contaminated coastal sea-water to co-operating laboratories. Tests to assure homogeneity of these samples are at various stages of completion, and several have already been distributed.

88. During the period covered by this report the Government of France made gifts of new equipment at a value of \$25 800 and the Government of the United States made a contribution for equipment at a value of \$21 500. In order to facilitate the execution of the programme of the Monaco Laboratory the United States has made an additional gift of equipment worth \$50 000.

International Centre for Theoretical Physics at Trieste

89. The highlights of the past year's activities of the Trieste Centre were two extended courses which were followed by "research workshops" in solid-state physics and in global analysis and its applications. The workshops and a summer college on global analysis were UNDP projects carried out by UNESCO through the Centre. SIDA has also provided funds for the solid-state physics programme.

90. The Centre also continued to carry out research in elementary particle physics throughout the year.

91. In September 1972 the Centre served as host to a symposium on the development of the physicist's conception of nature, organized by the universities of Trieste and Texas and

attended by 174 scientists, and in October 1972 to the foundation meeting of the International Federation of Institutes of Advanced Studies of which the Centre is a member. Altogether 930 scientists from 72 Member States took part in activities at the Centre in 1972.

92. SIDA and the Ford Foundation continued to provide funds in support of the associate membership scheme.

NUCLEAR TECHNOLOGY

General

93. Orders for nuclear power plants continued at a high level during the year with a marked acceleration in the last quarter, bringing the total for the year to 46 350 MW. As shown in the table below, the world's nuclear installed capacity in operation by the end of 1972 approached 35 200 MW. On the basis of existing orders, nuclear capacity is expected to exceed 120 000 MW by the end of 1975 and 300 000 MW in 1980.[11] World nuclear capacity is more tentatively estimated at 1 300 000 MW (30% of total electric capacity) in 1990 and 3 500 000 MW (50% of total electric capacity) in the year 2000.

Table 9

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

| | 1970 | 1972 | 1975 | 1980 | 1985 | 1990 | 2000 |
|------------------------------------|------|------|------|------|------|------|------|
| Electrical | 1100 | 1250 | 1600 | 2300 | 3200 | 4300 | 7000 |
| Nuclear | 21 | 37 | 120 | 315 | 700 | 1300 | 3500 |
| Percentage share of nuclear (%) | 2 | 3 | 7.5 | 14 | 22 | 30 | 50 |

94. The capital costs of nuclear plants are nearly three times higher than in 1968/69, but appear to have stabilized. There have been almost the same proportionate increases in the capital costs of conventional stations which have been particularly affected by requirements to install special equipment to prevent pollution.

95. The costs of a nuclear fuel cycle have remained steady. Fossil fuel prices have not only continued to rise in 1972, but are expected to go on doing so at a minimum rate of 4% a year for the foreseeable future. It may be inferred therefore that regard for the stability of future fuel costs may be one of the main reasons for the rapid growth in orders for nuclear plants.

Power reactors

96. The market survey for nuclear power in developing countries, launched in 1971/72, has been completed for 14 countries, which were visited by missions between July 1972 and January 1973. Several additional countries have since requested similar missions. Financial support and specialist services were provided for the survey by IBRD, the Inter-American Development Bank, and several advanced countries. The detailed result of the market survey will be presented separately [12] but in summary it has shown that for

[11] The figure for 1975 may be reduced if there are further substantial delays in licensing and commissioning while the figure for 1980 will be affected by the rate of ordering and construction starts in the next 18 months.

[12] Document GC(XVII)/506.

nuclear power plants to be commissioned in developing countries in the years 1980-89, there is no economically justifiable market in unit sizes below 200 MW; and that the total market under the economic conditions believed most likely to prevail would be:

| <u>Unit size (MW)</u> | <u>Market (MW)</u> |
|-----------------------|--------------------|
| 200 - 400 | 800 - 3 000 |
| 600 | 24 600 - 27 600 |
| 800 - 1 000 | 24 400 - 31 000 |

97. The market survey has helped to put at the Agency's disposal advanced computer-based analytical methods for making estimates of the costs of alternative long-term patterns of expansion of national or regional electric power systems. This capability is being used in technical assistance projects and in advising Member States on the planning of nuclear power programmes.

98. A manual on the steps involved in planning a nuclear power programme and procuring in particular the first nuclear power station will be published in August 1973.

99. The work of the international working group on reactor pressure vessels is being terminated. A more general programme to assist reactor operators to obtain assurance of the continued reliability of their plant is being drawn up. A panel on this subject was held at the end of May 1973.

Supply of nuclear materials

100. 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 Table 10 below.

Table 10

Supply of nuclear materials

| Receiving State/organization | Purpose | Quantity and type of fissile material | Approximate enrichment (when applicable) |
|------------------------------|---|---|--|
| Chile | Medical therapy | 150 mg ^{238}Pu in a heart pacemaker ^{a/} | |
| IAEA | Safeguards analytical methods | 0.75 g Pu in 2 plutonium sulphate standards ^{a/} | |
| IAEA | Safeguards analytical methods | 80 mg ^{233}U and 15 mg ^{242}Pu ^{a/} | |
| IAEA | Safeguards analytical methods | 1.16 g ^{238}Pu in assay machine ^{a/} | |
| IAEA | Calibration of reference standards | 1 kg slightly enriched UO_2 in 200 samples of 5 g each ^{a/} | |
| IAEA | Safeguards analytical methods | 36 U_3O_8 standards of 200 g each with various enrichments ^{a/} | 0.6-10% |
| IAEA | Safeguards analytical methods | 25 neutron flux monitors with 1 g ^{235}U , 1 g ^{237}Np and 10 μg ^{252}Cf in each monitor ^{a/} | |
| IAEA | Safeguards analytical methods | 6 plutonium metal, 8 plutonium sulphate and 6 U_3O_8 standards ^{a/} | |
| IAEA | For use in Agency meeting on nuclear accident dosimetry | 6 fission foils with 2 mg ^{238}U , 76 μg ^{239}Pu and 800 μg ^{237}Np ^{a/} | |
| India | Research | 10 mg ^{240}Pu ^{a/} | |
| India | Research | 200 mg ^{232}U ^{a/} | |
| India | Research | 0.5 g Pu in standard and 0.08 g ^{235}U in 5 standards ^{a/} | 1- 2% |

| Receiving State/ organization | Purpose | Quantity and type of fissile material | Approximate enrichment (when applicable) |
|----------------------------------|----------------------------------|---|--|
| India | Research | 5 g ^{235}U in 10 samples with various enrichments ^{a/} | 5-90% |
| India | Research | 2 depleted uranium samples and 1 g ^{235}U in 4 samples with various enrichments ^{a/} | 0.2-50% |
| India | Research | 10 g ^{235}U ^{a/} | 93% |
| India | Research | 1 U_3O_8 standard ^{a/} | 93% |
| Korea, Republic of | Research contract No. 1105 | 3.88 mg ^{235}U in neutron beam monitor ^{a/} | |
| Mexico | Fuel for a research reactor | 760 g ^{235}U | 20% |
| Mexico | Fuel for a research reactor | 7560 g ^{235}U | 70% |
| Romania | Fuel for a research reactor | 9294 g ^{235}U | 20% |
| Romania | Fuel for a research reactor | 31 945.50 g ^{235}U | 93% |
| Turkey | Research contract No. 587 | 3 ^{235}U standards ^{a/} | 10, 40, 80% |
| Turkey | Fuel for a sub-critical assembly | 104 kg uranium | 1.143% |
| Yugoslavia | Research | ^{239}Pu , ^{230}Th , ^{241}Am in four standards ^{a/} | |

^{a/} Supplied under the authority referred to above.

101. The allocation of special fissionable material to the value of \$50 000 granted by the United States for 1972 is shown in the table below.

Table 11

Allocation of special fissionable material granted
by the United States for 1972

| Receiving State | Value in dollars |
|-----------------|------------------|
| Chile | 9 270 |
| Greece | 20 000 |
| Iraq | 690 |
| Mexico | 9 160 |
| Romania | 2 360 |
| Yugoslavia | 8 520 |
| | 50 000 |

Reactor physics and research reactors

102. In response to interest shown by developing countries in the design and capabilities of irradiation rigs currently in use, a symposium on irradiation facilities for research reactors was held in Teheran in November 1972. In March 1973 the Agency convened a regional study group in Bombay to discuss the practical problems that face research reactor centres in developing countries and, in particular, the problems of managing such centres.

103. In January 1973 the Agency held a symposium in Prague to review new developments in the control and instrumentation of nuclear power plants and the experience gained from the increasing number of plants in operation. The relevant working group of the Agency continued to advise Member States and sponsored two specialist meetings, one in Kjeller, Norway, on the reliability of control and protection systems in November 1972 and one in Paris on process instrumentation in June 1973.

104. In October 1972 the Agency together with NEA and the French Atomic Energy Commission organized an international conference in Paris on reactor shielding. The conference discussed problems encountered in power reactor shielding, from the design up to the operational stage. It considered cost reductions that could result from improvements in methods of computation and more accurate nuclear data, the need for which was strongly stressed.

105. The joint Agency/NEA liaison group on MHD held its ninth meeting in Paris in 1973. A comprehensive status report on MHD was published in the Agency's Atomic Energy Review in 1972.

106. In view of significant developments in controlled thermonuclear fusion reactor research, the Agency has obtained the advice of consultants on how to extend its programme so as to include fusion reactor engineering.

107. In July 1972 the Agency held a meeting in Athens to discuss the results of an international comparison of chemical dosimeters used in reactor radiation measurements, a matter of basic importance in reactor technology. A comparison of methods for evaluating neutron spectra by the use of activation detectors has also been organized.

Fast breeder reactors

108. The sixth annual meeting of the Agency's International Working Group on Fast Reactors met in Vienna in May 1973 to review national programmes on liquid metal fast breeder reactor development and to co-ordinate international meetings on this subject. The Working Group also sponsored meetings on:

- (a) Measurement and control of sodium impurities, at Cadarache, France, in November 1972;
- (b) Decontamination of plant components from sodium and radioactivity, at Dounreay, United Kingdom, in April 1973; and
- (c) Development and application of absorber materials in June 1973.

109. The Working Group co-operated in an international conference on engineering of fast reactors for safe and reliable operation, held in Karlsruhe by the authorities of the Federal Republic of Germany in October 1972. The Agency also sponsored a study group meeting in Minsk in July 1972 to review the status and future of gas-cooled fast reactors which are receiving increasing attention.

Nuclear materials

110. The joint Agency/NEA working party on world uranium resources and production met in Paris in October 1972, and in Vienna in March 1973, to prepare a new report which will show considerable changes in world reserves outside China, the Soviet Union and the Eastern European countries with the exception of Yugoslavia, since the last report in 1970. A meeting was held in Vienna in November 1972 on the specifications for the performance of instruments used in prospecting for and developing uranium resources. Technical assistance in uranium prospecting and development was given to Brazil, Cameroon, Colombia, Egypt, Greece, Mexico, Morocco, Pakistan, Peru and Turkey during 1972.

Nuclear fuel technology

111. The Agency has launched a co-ordinated programme for research on the bacterial leaching of uranium ores. A study group on nuclear fuel manufacture was held in Grenoble, France, in September 1972 to inform senior technical staff from interested countries about the technical and economic requirements which would have to be met if national plants for uranium and processing fuel were to be set up. A panel in Vienna in May 1973 reviewed the present status of the sol-gel processes for fuel fabrication.

Nuclear explosions for peaceful purposes

112. The third international panel on nuclear explosions for peaceful purposes met in Vienna in November 1972 to review recently released information about the applications, characteristics and effects of such explosions. The panel recommended that a meeting be held towards the end of 1973 to help the Agency draw up detailed procedures for dealing with requests for assistance in regard to the peaceful uses of nuclear explosions.

NUCLEAR SAFETY AND ENVIRONMENTAL PROTECTION

General

113. During the period covered by the report, the Agency's programme of activity on nuclear safety and environmental protection included five symposia and twelve panels (about twice as many as in previous years) as well as eight consultants' meetings and eight publications. The Agency has continued to carry out the programme in close co-operation with WHO and with NEA, FAO and ILO. It has also taken an active part in the work of UNSCEAR, IMCO and the Joint Group of Experts on the Scientific Aspects of Marine Pollution.

Research support

114. Table 12 below shows the distribution of research contracts and agreements relating to radiological and environmental protection including radioactive waste management.

Table 12
Research contracts on radiological and
environmental protection

| Subject | Countries in which research is carried out with Agency support | Cost to the Agency in 1972 (in dollars) |
|---|--|---|
| General matters of radiation protection | Austria, Belgium, Bulgaria, Czechoslovakia, Greece, Israel, Netherlands, Soviet Union and Yugoslavia | 14 500 |
| Measurement techniques | Czechoslovakia, Egypt, India and Romania | 11 500 |
| Accident dosimetry | Bulgaria, Canada, Czechoslovakia, France, Federal Republic of Germany, Hungary, India, Japan, Poland, Soviet Union, United Kingdom, United States and Yugoslavia | 11 300 |
| Environmental studies | Argentina, Bangladesh, Czechoslovakia, Egypt, Finland, Federal Republic of Germany, Greece, India, Indonesia, Republic of Korea, Mexico, Netherlands, Philippines, Poland and Thailand | 102 700 |

Radiological safety

115. The Agency has undertaken the following activities relating to radiological safety during the period covered by this report:

- (a) A symposium on neutron monitoring for radiation protection purposes was convened in Vienna in December 1972;
- (b) Two panels were held in collaboration with WHO, to compile manuals of guidance on the safe use of radioactive tracers in industrial processes and on environmental monitoring programmes and assessment of the significance of environmental contamination;
- (c) A series of panels was held to review and prepare guidelines on methods for assessing the capacity of various sectors of the environment to accept safely radioactive materials; to consider the assessment of radiological hazards in uranium and thorium mines; and to review the methods of particle size analysis which can be used in the estimation of airborne radioactive contamination;
- (d) A regional study group met in Istanbul in November 1972 to discuss radiological and environmental protection for Europe, the Middle East and the Mediterranean area;
- (e) A co-ordinated research programme was carried out for the comparison and calibration of whole-body monitors and another on environmental monitoring for radiation protection for countries in South East Asia; and
- (f) A meeting was held in Vinča, Yugoslavia, in May 1973 on nuclear accident dosimetry to perform the third and final intercomparison experiment in this series.

116. Work on the preparation or completion of the following has continued:

- (a) A manual on the application of the transport regulations;
- (b) A guide-book on the establishment and keeping of monitoring records;
- (c) A manual on the radiological health aspects of the operation of neutron generators;
- (d) A manual of guidance on neutron monitoring;
- (e) A manual containing selected criteria and data for the evaluation of radiation emergencies and accidents;
- (f) A survey of releases of radioactive material to the environment by the nuclear industry at the present time and as predicted to the year 2000; and
- (g) A study of cost-benefit concepts as related to radiological protection and safety.

In September 1972 the Board of Governors approved the revised Regulations for Safe Transport of Radioactive Materials.

Waste management

117. An important object of the programme on waste management is to develop standards of safety for the dispersion of radioactive waste into the environment. For this purpose, two co-ordinated research programmes have been started and the following meetings were held during the period under review:

- (a) A symposium on the interaction of radionuclides with constituents of marine environment (Seattle, United States, July 1972);
- (b) A symposium on the environmental behaviour of radionuclides released in the nuclear industry (Aix-en-Provence, France, May 1973); and
- (c) A panel to develop methods for establishing the capacity of the environment to accept radioactive materials (Vienna, May 1973).

118. The Agency also convened panels to study the choice of burial conditions for concentrates of radioactive waste and to review the possibilities of establishing international sites for storage of high-level and alpha-bearing wastes. These and other new activities are pursuant to the recommendations of the United Nations Conference on the Human Environment for closer international co-operation on radioactive waste problems. The Agency is also preparing guidelines to help those countries which do not have nuclear fuel reprocessing facilities to select appropriate waste management systems.

119. A summary of the projected production of radioactive wastes and some specific radionuclides of concern is given in Table 13 below.

Table 13

Projected world production of radioactive
wastes arising from fuel reprocessing

| | 1980 | 1990 | 2000 |
|---|------|--------|--------|
| Installed nuclear capacity (1000 MW) | 345 | 1 610 | 4 260 |
| Fuel reprocessed (1000 tons/year) | 7 | 35 | 80 |
| Volume of liquid waste | | | |
| Generated annually (1000 m ³) | 8 | 45 | 100 |
| Accumulated (1000 m ³) | 38 | 370 | 1 290 |
| Volume of solid waste | | | |
| Generated annually (1000 m ³) | 0.6 | 3 | 7 |
| Accumulated (1000 m ³) | 3 | 27 | 96 |
| Accumulated radionuclides | | | |
| ⁹⁰ Sr (microcurie) | 2200 | 20 000 | 54 000 |
| ²³⁹ Pu (microcurie) <u>a/</u> | 0.05 | 1.0 | 7 |
| ²⁴¹ Am (microcurie) <u>a/</u> | 5 | 100 | 700 |

a/ 0.5% of Pu and 100% of Am assumed to be in waste.

120. A symposium on the management of radioactive wastes from nuclear fuel reprocessing was held in Paris in November 1972.

121. The Agency also gave more attention to the effects on the environment of various types of non-radioactive releases from nuclear power plants. The work of a panel on the effects of thermal discharges from nuclear power plants will be used to prepare and publish a technical report this year. The Agency is also arranging a co-ordinated research programme on the environmental effects of cooling systems and of thermal discharges.

122. A consultants' meeting was held in April 1973 and a panel was convened in Vienna in June 1973 to formulate recommendations for the discharge by the Agency of its responsibilities under the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter [13]. The panel's recommendations included a definition of high-level radioactive wastes or other high-level radioactive matter unsuitable for dumping at sea and provisions for the control of the dumping of other radioactive material in accordance with the objectives and requirements of the Convention. The recommendations will be discussed by the Board in September 1973.

Nuclear safety

123. The Agency sent safety missions to the Democritos Centre in Greece, the Teheran Nuclear Centre, the Reactor Centre in the Philippines, the Bandung Reactor Centre in Indonesia in September 1972 and to the research reactors in Argentina, Brazil, Chile and Uruguay in May 1973. The missions reviewed the nuclear and radiological safety levels achieved at the various reactor centres, and the results were communicated to the national authorities concerned.

124. At the request of the Netherlands Government a second safety review was made of the KEMA suspension test reactor in Arnhem in December 1972. In April 1973 a mission reviewed the safety requirements of the Angra dos Reis nuclear power plant in Brazil and in June those of the Laguna Verde nuclear plant in Mexico.

125. The following meetings on nuclear safety have been organized during the period covered by this report:

- (a) A panel on reactor safety analysis (Vienna, December 1972); and
- (b) A symposium on principles and standards of reactor safety (Jülich, Federal Republic of Germany, February 1973).

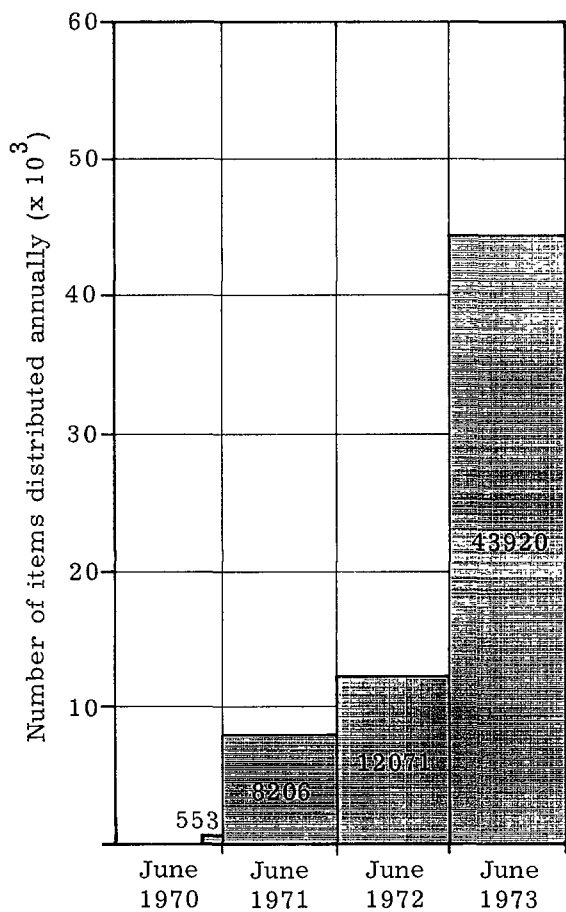
[13] See also para. 10 above of the Introduction.

INFORMATION AND TECHNICAL SERVICES

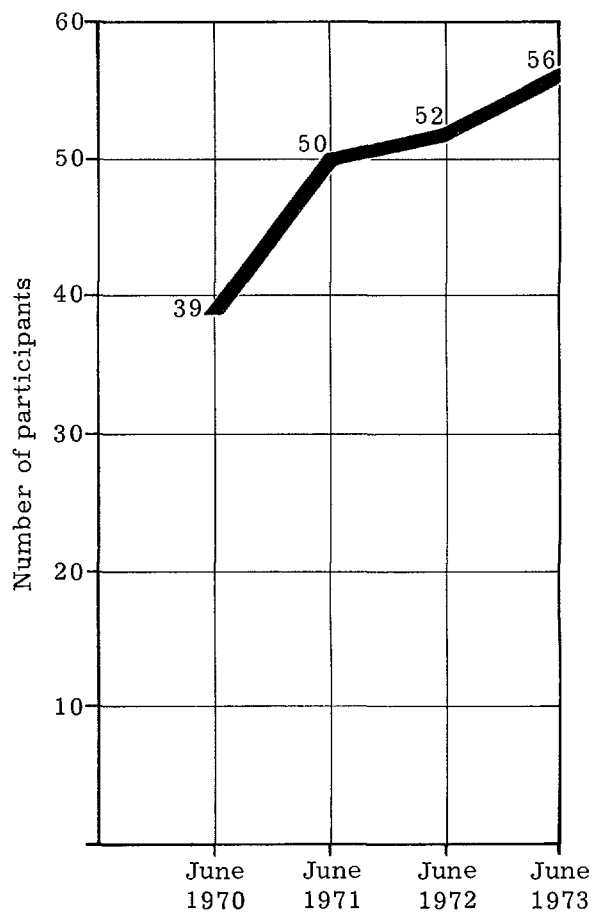
The International Nuclear Information System (INIS)

126. By June 1973, 44 Member States and 12 international organizations were participating in INIS. During the third year of INIS operation (July 1972 to June 1973), data on 43 920 items of nuclear science information were distributed to participants, as shown in the graphs below, representing an increase of almost 300% over the previous year.

A
Volume of INIS items distributed annually



B
Number of Member States and international organizations participating in INIS



127. The INIS Clearinghouse received a total of 57 annual subscriptions for abstracts on microfiche and 3011 ad hoc requests. At present, there are 15 standing orders for non-conventional literature on microfiche.

128. The first consultative meeting of all INIS Liaison Officers was held in Vienna in November 1972. Participants expressed general satisfaction with INIS operations and the meeting's main recommendations were:

- (a) That INIS should operate with full scope (complete instead of selective coverage of nuclear science information); this recommendation was put into effect in January 1973;
- (b) That Atomindex (the printed version of the INIS output computer tape) should be published twice a month; and
- (c) That prices for INIS output products should remain the same in 1973 as in 1972.

129. An INIS seminar on indexing and retrieval was held from 25 to 29 June 1973 in Vienna, and on-the-job training in INIS work was given during the year to four trainees from four participating Member States.

130. Close co-operation is continuing with UNESCO, and a special arrangement has been concluded with FAO whereby the Agency will help to establish and will process input for AGRIS according to INIS standards and formats.

Computer services

131. The IBM 370/145 computer was installed in July 1972. From July 1972 to June 1973 UNIDO's share of use of the computer decreased slightly from 25% to 24%. As a result of the expansion of INIS to full scope and twice-monthly issue of Atomindex, use of the computer by INIS increased from 23% to 30%. The use by the Agency's administrative service in June 1973 was 21% as compared with 25% in June 1972. There was continued close co-operation with UNIDO in the sharing of common computer programmes and the use of the common computer facility.

132. After a detailed study which showed that substantial savings could be obtained through purchase rather than leasing, the central processing unit of the computer with 256 K of storage was purchased in December 1972.

133. Since March 1968, by arrangements with NEA, the Agency has provided programmes from the computer programme library at Ispra, Italy, to Member States that are not members of NEA. During the last year 31 programmes and reports were sent to non-NEA countries, and 46 programmes were donated by such countries to the library.

Scientific meetings

134. Comparative information for the last two years in respect of conferences, symposia and seminars is given in the following table:

Table 14
Conferences, symposia and seminars

| Item | 1971-72 | 1972-73 |
|-----------------------|---------|---------|
| Meetings | 8 | 14 |
| Participants | 941 | 2460 |
| Countries taking part | 53 | 65 |
| Papers presented | 397 | 659 |

135. Revenues from the sale of publications and related material amounted to \$406 894 in 1972, compared with \$277 500 in 1971. The commercial value of publications distributed free to Member States was \$420 000.

SAFEGUARDING PEACEFUL NUCLEAR ACTIVITIES

Implementation of Agency safeguards

136. Table 15 at the end of this section shows the status, as at 30 June 1973, of signatures, ratifications and accessions with respect to NPT, and the progress made in the negotiation of safeguards agreements in connection therewith.

137. Table 16 shows the total number of safeguards agreements other than those connected with NPT, which were approved by the Board and the parties concerned by 30 June.

138. On 30 June, 26 safeguards agreements with non-nuclear-weapon States party to NPT were in force; 14 of these agreements were with States that at present have significant nuclear activities. It should be noted that there are also 16 project agreements, 27 transfer agreements and 4 unilateral submission agreements which provide for the application of Agency safeguards. Many of these agreements are with States that have no agreement in connection with NPT.

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

- (a) In connection with NPT, safeguards agreements jointly with EURATOM and its non-nuclear-weapon member States, and with Fiji, Ghana, Iran, Lebanon, Madagascar, Mauritius, Morocco, the Philippines and Viet-Nam;
- (b) In connection with NPT and the Tlatelolco Treaty, safeguards agreements with Costa Rica, the Dominican Republic and Mexico;
- (c) In connection with NPT and the additional Protocol I to the Tlatelolco Treaty, a safeguards agreement with the Netherlands in respect of the Netherlands Antilles and Surinam;
- (d) A unilateral submission agreement with the United Kingdom for the application of safeguards to certain nuclear materials; and
- (e) Unilateral submission agreements with Argentina for the application of safeguards to the Atucha Power Reactor Facility, and to certain nuclear materials.

140. To implement these agreements, Subsidiary Arrangements have been or are being prepared. The Agency is seeking standardization in the application of safeguards, through a series of model "Facility Attachments", for the main types of nuclear facilities containing safeguarded nuclear material. The Agency is also drawing up specific directives for implementing safeguards in each individual facility containing such material. Much work is being done to bring about effective and harmonious co-operation between Agency safeguards and the systems of accounting for, and control of, nuclear material of the States concerned.

141. A list of nuclear installations under Agency safeguards or containing safeguarded material under agreements approved by the Board is given in Annex E. The breakdown on 30 June 1973 as compared to 30 June 1972 is as follows:

| <u>Facilities</u> | <u>30 June 1972</u> | | <u>30 June 1973</u> | |
|--|---------------------|----------------|---------------------|----------------|
| | <u>NPT</u> | <u>Non-NPT</u> | <u>NPT</u> | <u>Non-NPT</u> |
| Nuclear power stations | 6 | 15 | 7 | 20 |
| Other reactors | 41 | 67 | 45 | 62 |
| Conversion plants, fabrication plants and fuel reprocessing plants | 8 | 12 | 8 | 12 |
| Other separate accountability areas | 10 | 84 | 35 | 90 |

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

| | <u>1971</u> | <u>1972</u> | <u>1971</u> | <u>1972</u> |
|----------------------------------|----------------------|-------------|----------------------------|-------------|
| | <u>Total element</u> | | <u>Fissionable isotope</u> | |
| | kg | kg | | |
| (a) Special fissionable material | | | | |
| Plutonium | 1 726 | 2 901 | | |
| Enriched uranium | 522 862 | 1 178 024 | 11 182 kg | 25 912 kg |
| (b) Source material | | | | |
| Natural uranium | 394 276 | 1 840 019 | | |
| Depleted uranium | 200 312 | 298 799 | | |
| Thorium | 227 | 6 676 | | |

143. During the period covered by this report the Agency carried out 451 inspections in 33 States (165 in connection with NPT), compared with 234 inspections in 19 States during the preceding twelve months.

144. More safeguards instruments have been introduced for routine operational use in the field; in some cases, it has been possible to use automatic camera equipment to replace part of the surveillance work so far carried out by inspectors. Non-destructive portable measuring equipment, such as multichannel analysers, was increasingly used during inspections.

145. Standardized procedures were introduced for the handling, shipment and analysis of samples of nuclear material taken during inspections.

146. A computer-based central nuclear material accounting and information system is being developed. The first stage of the programme - to process the information received from States - is now under testing. The existing accounting system is being adapted accordingly.

Research and development programme

147. During the period covered by this report:

- (a) Further work was done on defining the safeguards requirements for isotope enrichment facilities. The working group which met in June 1972 [14] gave

[14] See document GC(XVI)/480, para. 132.

the general direction to be followed. The first practical application of this work has been in developing guidelines for experimental safeguards at an enrichment facility;

- (b) A technical working group in August 1972 advised the Secretariat on procedures for evaluating the accuracy of accounting and the effectiveness of safeguards, on the design of sampling plans to optimize the allocation of inspection effort, and on a quantification of results to be achieved in applying safeguards; and
- (c) Progress has been made in preparing the Safeguards Technical Manual which will lay down the general procedures to be used by the Agency's staff in carrying out inspections.

148. In relation to methods and techniques:

- (a) Successful tests were made of non-destructive measurement techniques involving the use of portable instruments. The various instruments and techniques have been used to determine the enrichment of low-enriched material such as uranium oxide powders, scrap and waste, and uranium oxide in fuel rods; and
- (b) Progress has been made in developing methods to measure volume by a tamper-indicating system and to determine fissile and fertile isotopes of plutonium in solid waste. Instruments for unattended surveillance of safeguarded facilities have been tested; these included a self-contained camera system in a secure container, triggered by various types of sensors. Progress has also been made in developing instruments for in-line determination of uranium and plutonium, flow-surveillance and monitoring of neutron flux.

149. For safeguarding reprocessing plants, the Agency has developed methods to:

- (a) Record automatically the chronological processing events in the head-end;
- (b) Determine rapidly and on the spot the heavy element concentration in concentrated decontaminated product solutions; and
- (c) Determine the content of plutonium and uranium in waste solutions.

150. An instrument has also been developed to detect and monitor the flow of nuclear materials to and from the input accountability vessel of the reprocessing plant.

151. The Agency has concluded an agreement with the Austrian Government under which the latter will build and lease a Safeguards Analytical Laboratory to the Agency. The Agency has begun to procure the necessary equipment for the laboratory.

152. Field operations have resulted in:

- (a) An evaluation of the results of two field tests of safeguards procedures for fuel fabrication plants;

- (b) Publication of recommendations for the physical protection of nuclear material. Some 500 copies have been distributed to 47 Member States at their request; and
- (c) Arrangements to enable the Agency to gain experience in using a network of national laboratories which, it is expected, will carry out most of the analyses of samples of nuclear material taken during inspections. Work has also been done on standardizing methods for analyses, selecting reference material, drawing up guidelines for the network and preparing a programme for the control of the quality of analyses carried out by the laboratories.

153. Research and technical contracts being carried out with the Agency's support are summarized in Table 17.

RATIFICATIONS/ACCESSIONS AND SIGNATURES
TO NPT
as of 30 June 1973



States which have ratified or acceded to NPT



States which have signed NPT

Table 15

Situation on 30 June 1973 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 | Under negotiation |
| Austria | 28 June 1969 | In force: 23 July 1972 |
| Barbados | | |
| Belgium | | Signed: 5 April 1973 |
| Bolivia | 26 May 1970 | Under negotiation |
| Botswana | 28 April 1969 | Under negotiation |
| Bulgaria | 5 September 1969 | In force: 29 February 1972 |
| Burundi | 19 March 1971 | |
| Cameroon | 8 January 1969 | |
| 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 | Approved by the Board |
| 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 | Signed: 22 May 1973 |
| Ecuador | 7 March 1969 | Under negotiation |
| Egypt, Arab Republic of | | |
| El Salvador | 11 July 1972 | |
| Ethiopia | 5 February 1970 | |
| Fiji | 14 July 1972 | In force: 22 March 1973 |
| Finland | 5 February 1969 | In force: 9 February 1972 |
| Gambia | | |
| German Democratic Republic | 31 October 1969 | In force: 7 March 1972 |
| Germany, Federal Republic of | | Signed: 5 April 1973 |
| Ghana | 5 May 1970 | Approved by the Board |
| Greece | 11 March 1970 | Provisionally in force: 1 March 1972 |
| Guatemala | 22 September 1970 | Under negotiation |
| Haiti | 2 June 1970 | Under negotiation |
| Holy See | 25 February 1971 | In force: 1 August 1972 |
| Honduras | 16 May 1973 | |
| Hungary | 27 May 1969 | In force: 30 March 1972 |
| Iceland | 18 July 1969 | Signed: 12 July 1972 |
| Indonesia | | |
| Iran | 2 February 1970 | Signed: 19 June 1973 |
| 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 | | |
| Jamaica | 5 March 1970 | Under negotiation |
| Japan | | |
| Jordan | 11 February 1970 | Under negotiation |
| Kenya | 11 July 1970 | Under negotiation |
| Khmer Republic | 2 June 1972 | |
| Korea, Republic of | | |

| (1) | (2) | (3) |
|----------------------------------|-------------------|----------------------------|
| 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 |
| 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 | Signed: 27 September 1972 |
| 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 | | |
| Nigeria | 27 September 1968 | Under negotiation |
| Norway | 5 February 1969 | In force: 1 March 1972 |
| Panama | | |
| Paraguay | 4 February 1970 | |
| Peru | 3 March 1970 | |
| 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 | | |
| Sri Lanka | | |
| Swaziland | 11 December 1969 | Under negotiation |
| Sweden | 9 January 1970 | Under negotiation |
| Switzerland | | |
| Syrian Arab Republic | 24 September 1969 | |
| Thailand | 7 December 1972 | Under negotiation |
| 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 | Signed: 3 October 1972 |
| Yemen, Arab Republic of | | |
| Yugoslavia | 3 March 1970 | Signed: 26 May 1972 |
| 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 16
Safeguards Agreements other than those in connection with NPT,
approved by the Board as of 30 June 1973

| Party(ies) ^{a/} | Subject | Entry into force | INFCIRC |
|---|--|------------------|------------|
| <u>Project Agreements</u> | | | |
| Argentina | Siemens SUR-100 | 13 Mar 1970 | 143 |
| | RAEP Reactor | 1 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 | UTRR Reactor | 10 May 1967 | 97 |
| Japan | JRR-3 | 24 Mar 1959 | 3 |
| Mexico | TRIGA-III Reactor | 18 Dec 1963 | 52 |
| | Siemens SUR-100 | 21 Dec 1971 | 162 |
| 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 | - |
| Spain | Coral I Reactor | 23 Jan 1967 | 99 |
| Uruguay | URR Reactor | 24 Sep 1965 | 67 |
| Viet-Nam | VNR-1 Reactor | 16 Oct 1967 | 106 |
| Yugoslavia | TRIGA-II Reactor | 4 Oct 1961 | 32 |
| Zaire, Republic of ^{b/} | TRICO Reactor | 27 Jun 1962 | 37 |
| <u>Transfer Agreements</u> | | | |
| (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 | | 20 Jul 1972 | 170 |
| Austria ^{b/} /USA | | 24 Jan 1970 | 152 |
| Brazil/USA | | 20 Sep 1972 | 110/Mod. 1 |
| Canada/Japan | | 12 Nov 1969 | 85 |
| 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 | 100 |
| Iran/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 |
| 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/USA | | 10 Sep 1965 | 68 |
| Turkey/USA | | 5 Jun 1969 | 123 |
| Venezuela/USA | | 27 Mar 1968 | 122 |
| Viet-Nam/USA | | 25 Oct 1965 | 71 |
| <u>Unilateral submissions</u> | | | |
| Argentina | Atucha Power Reactor Facility | 3 Oct 1972 | 168 |
| | Nuclear material | - | - |
| China, Republic of | Taiwan Research Reactor Facility | 13 Oct 1969 | 133 |
| Mexico | All nuclear activities | 6 Sep 1968 | 118 |
| United Kingdom | Certain nuclear material | 16 Dec 1972 | 175 |

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 (see Table 15).

Table 17





Contracts for safeguards research and development

| Title | Institute | Agency contribution in dollars |
|--|--|--------------------------------|
| Study of a non-destructive measurement method for highly enriched U-Al alloy plate fuel | Sumitomo Electric Industries Ltd., Osaka, Japan | nil |
| Collection of gamma spectra data of irradiated light water moderated reactor spent fuel and study of the applicability of the method for fuel identification | Japan Atomic Energy Research Institute, Tokyo | 10 000 |
| Feasibility study for the safeguards use of NMR method for the isotopic assay of uranium-235 in UF ₆ streams with different enrichments | Institute of Atomic Physics, Bucharest | 4 920 |
| Development and fabrication of mini gamma spectrometric probe for measurements of uranium enrichment in fuel clusters | Aktiebolaget Atomenergi, Nykoeping, Sweden | 18 800 |
| Measurement of neutron decay constant in a highly subcritical reactor as a safeguard method | Institute of Nuclear Energetics, Academy of Sciences, Minsk-Sosni, Soviet Union | nil |
| Integral safeguards experiment at the Novo-Voronezh LWR Power Reactor Plant | I. V. Kurchatov Institute of Atomic Energy/Novo-Voronezh Nuclear Power Station, Soviet Union | 40 000 |
| Nuclear material transfer monitor | United Kingdom Atomic Energy Authority, Risley, Warrington, United Kingdom | 9 300 |
| Portable gamma absorptiometer for safeguards use in nuclear fuel processing plants | United Kingdom Atomic Energy Authority, Aldermaston, United Kingdom | 13 000 |
| Assay of total plutonium content in fuel plates in storage containers | General Reactor Physics Division, AEE Winfrith, United Kingdom | 2 800 |
| Tamper-resistant instrumentation for a chemical reprocessing plant | Braddock, Dunn and McDonald Ind., McLean, United States | 19 900 |
| Application of gamma spectrometry techniques in combination with weighing for material balance taking in the production of highly enriched U-Al fuel | Atomic Energy Control Board of Canada and Eldorado Nuclear Limited | 3 400 |
| Fingerprinting and containment of fuel elements for safeguards of an Atucha-type reactor | Comisión Nacional de Energía Atómica, Buenos Aires | 7 500 |
| Integral experiments restricted at key points of control for highly enriched fuel element cycle from fabrication plant to dissolver of reprocessing plant | Centre d'Etudes de l'Energie Nucléaire, Mol, Belgium | 13 000 |
| Development, demonstration and application of non-destructive instrumental techniques for assay of special nuclear material during fabrication of LWR fuel | Centre d'Etudes de l'Energie Nucléaire, Mol, Belgium | 5 000 |

| Title | Institute | Agency contribution in dollars |
|--|---|--------------------------------|
| Development, demonstration and application of non-destructive instrumental techniques for assay of PuO ₂ | Centre d'Etudes de l'Energie Nucléaire, Mol, Belgium | 1 000 |
| Testing of prototype plutonium separation and detection equipment of waste streams from a reprocessing plant | Eurochemic, Mol, Belgium | 2 700 |
| Development and evaluation of NDA techniques for measurement of U and Pu at mixed oxide fuel fabrication plant | Centre d'Etudes de l'Energie Nucléaire, Mol, Belgium | 10 000 |
| Development of fabrication of probes and auxiliary equipment for measurement of plutonium using neutron coincidence counting technique | Institute of Physics, Bulgarian Academy of Sciences, Sofia | 8 200 |
| Development of special gamma spectrometric detectors | Nuclear Research Institute, Prague | 17 900 |
| Optimization of safeguards effort | Institut für Angewandte Systemtechnik und Reaktorphysik, Gesellschaft für Kernforschung, Karlsruhe, Federal Republic of Germany | 4 000 |
| Consultancy agreement on safeguards instrumentation at Bradwell | Bradwell Nuclear Power Station and Central Electricity Generating Board, United Kingdom | 2 000 |
| Service contract with GE on installation of time domain reflectometry probe | General Electric Co., San José, California, United States | 9 000 |
| Testing of safeguards equipment | Oesterreichische Studiengesellschaft für Atomenergie, Vienna | 500 |

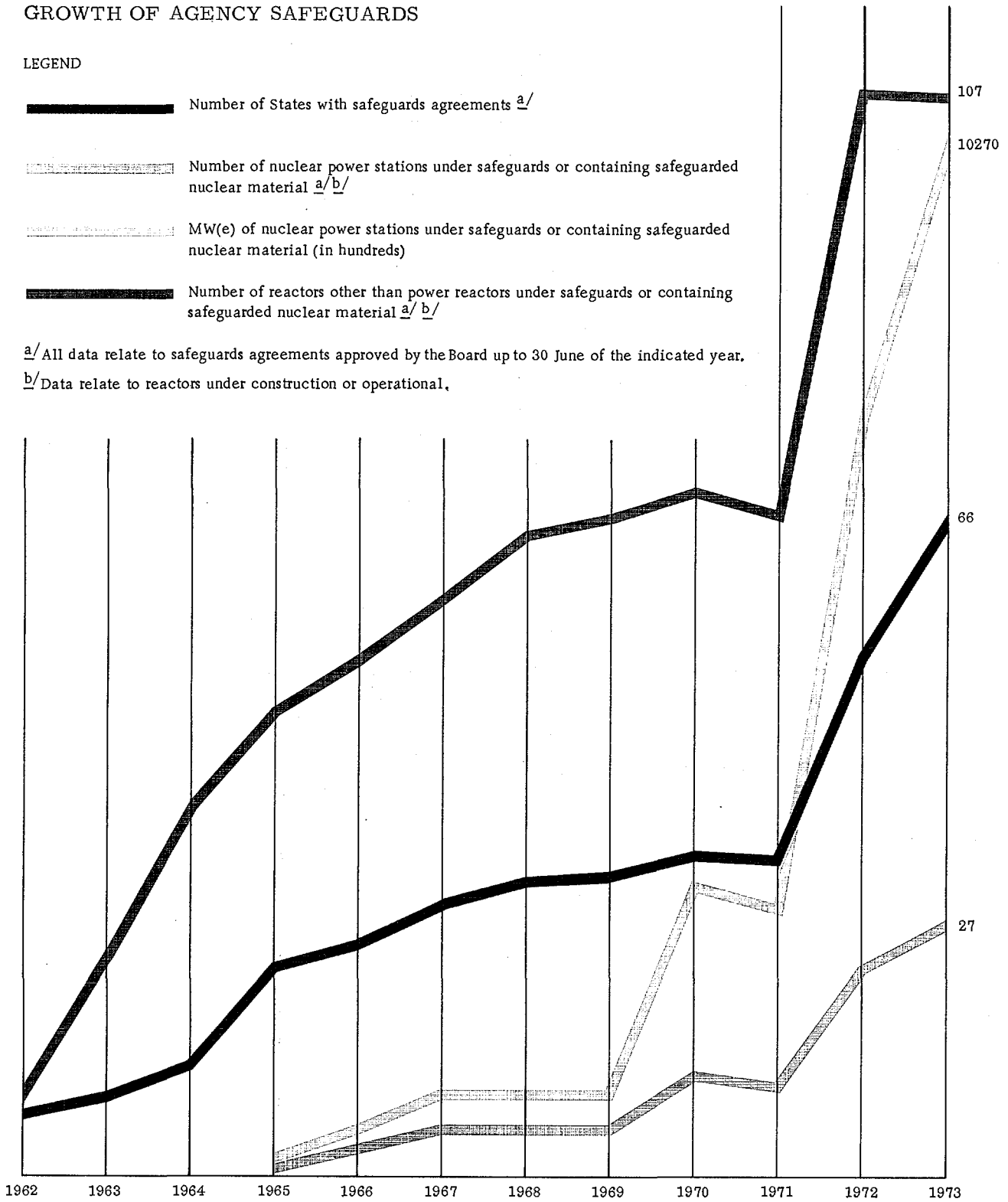
GROWTH OF AGENCY SAFEGUARDS

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 (in hundreds)
-  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

154. The main activities in external relations and legal matters are referred to in the Introduction and in the chapters on technical activities.

155. The Agency, UNIDO and the Austrian authorities have continued consultations concerning plans for the United Nations International Centre at Donaupark in Vienna, which will house the permanent headquarters of the two organizations. Construction is beginning in 1973. Both Secretariats are examining the extent to which common services should be expanded.

156. The Director General exchanged letters with the Director of the Joint Institute for Nuclear Research (Dubna, Soviet Union) to effect closer working co-operation. These provide for the sharing of operational experiences, increased reciprocal participation in scientific meetings and other specified measures for future collaboration.

157. Steps have been taken to resolve the difficulties which would arise from the simultaneous application of the Vienna Convention on Civil Liability for Nuclear Damage and the Paris Convention on Third Party Liability in the Field of Nuclear Energy, with respect to the designation of the liable operator, the jurisdiction and the territorial scope of the Conventions. Various solutions are now being considered, in particular the possibility of all States party to the Paris Convention becoming party to the Vienna Convention as well, or perhaps the elaboration of a Protocol establishing a reciprocal relationship among the parties to both Conventions.

158. Advice has been given to the Mexican authorities on licensing regulations for nuclear power plants. The Agency also provided advice to the authorities in Iraq, Lebanon, Kuwait, Malaysia, Saudi Arabia and Sri Lanka in the framing of basic legislation on atomic energy and radiation safety regulations. Three lawyers from Bulgaria, the Federal Republic of Germany and Hungary were trained in the legal aspects of atomic energy at the Agency's Headquarters.

159. A regional seminar in nuclear law, held in Rio de Janeiro in June 1973, discussed the current status of nuclear legislation in Latin American countries, the licensing and liability aspects of a nuclear power programme, and the Agency's safeguards in connection with NPT and the Tlatelolco Treaty.

160. By 30 June 1973, 41 Member States had accepted the Agreement on Privileges and Immunities of the Agency. [15]

[15] INFCIRC/9/Rev. 2.

PERSONNEL

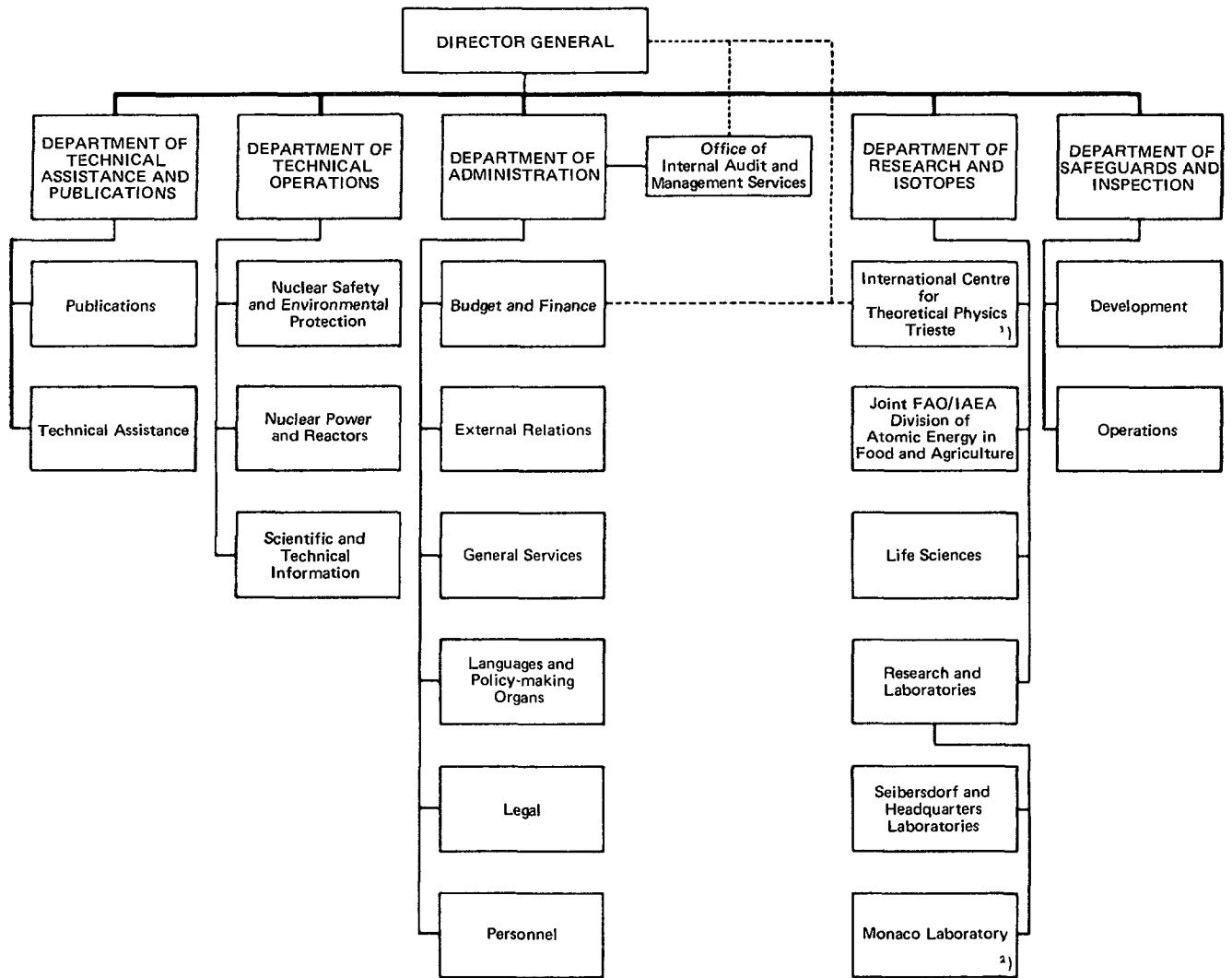
161. On 30 June 1973 the Secretariat had 339 staff members in the Professional and higher categories, 556 General Service staff and 234 staff members in the Maintenance and Operatives Service. The number of nationalities represented among that portion of staff which is subject to geographical distribution was 56 as compared to 54 on 30 June 1972.

162. Negotiations with the Austrian Government on a new social security agreement were concluded in early 1973.

163. A study is being made for the purpose of developing a set of rules which will ensure adequate radiation protection of individuals for whose safety the Agency is responsible.

164. The following organizational chart shows the structure of the Secretariat as at 30 June 1973.

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 1972

165. The original assessment of contributions on Member States included in the scale of assessment for 1972 amounted to \$15 392 000. The additional assessment for Bangladesh, which became a Member after the scale for 1972 had been established, increased the total by \$5934 to \$15 397 934.

166. By 31 December 1972 the Agency received contributions towards the Regular Budget for 1972 amounting to \$14 272 632, which represents 92.69% of the total amount assessed. By 30 June 1973 \$14 482 751 or 94.06% of the 1972 Regular Budget assessment had been received.

167. The Agency's obligations for 1972 amounted to \$16 531 709, which resulted in budgetary savings of \$272 487 from the appropriations for 1972. A further amount of \$136 019 from miscellaneous income brought the total budgetary surplus at 31 December 1972 to \$408 506. [16] Since contributions in the amount of \$1 125 302 were outstanding for 1972, there was a provisional cash deficit of \$716 796.

168. Savings under three appropriation Sections totalling \$525 879 were transferred to four other appropriation Sections; these transfers were necessary due to price and salary increases and to the distribution of interpretation service costs to those sections which actually used the services, based on a standard charge per man-day of interpretation.

The financial year 1973

169. The General Conference approved the scale of assessment and Regular Budget appropriations for 1973 which involve assessment on Member States of an amount of \$16 750 000; [17] with the additional assessment of Bangladesh, which became a Member after the scale for 1973 had been prepared, the amount of the assessment was increased to \$16 756 307.

170. By 30 June 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 | \$1 887 020 |
| Contributions to the Regular Budget for 1973 | \$8 563 750 |

By that date Member States had thus paid 94.31% of the total required advances to the Working Capital Fund and 51.11% of the total contributions due to the 1973 Regular Budget.

Operational Budget

171. At its fifteenth (1971) regular session the Conference increased the target for voluntary contributions from \$2.5 million to \$3 million. There was a shortfall of approximately \$508 000 in the actual pledges made by Member States. Of a total amount of \$2 492 105 pledged to the General Fund for 1972, \$2 204 205 had been paid by 31 December 1972. By 30 June 1973 receipts amounted to \$2 447 455 leaving a balance of \$44 650 still to be paid.

[16] See Statement I. C of the Agency's Accounts for 1972, document GC(XVII)/504.

[17] Resolutions GC(XVI)/RES/295 and 292 respectively.

172. The total operational obligations incurred during 1972 amounted to \$5 026 576. Unliquidated obligations as at 31 December 1972 including obligations brought forward from the previous years amounted to \$1 600 707.

The Agency's resources in 1972

173. Resources equivalent to more than \$25 million were at the Agency's disposal during 1972 under its own programme, UNDP accounts and other special projects, including contributions in cash, services and kind. Details concerning these resources are included in the Agency's Accounts for 1972[18].

[18] Document GC(XVII)/504.

ANNEX A

FELLOWSHIPS OFFERED OR PROVIDED FREE OF CHARGE IN 1972

| Donor | Number of fellowships | |
|--|-----------------------|-----------------------|
| | Available | Awarded ^{a/} |
| <u>Member States</u> | | |
| Argentina | 5 | 6 |
| Austria | 2 | 2 |
| Belgium | 6 | 5 |
| Brazil | 10 | 3 |
| Bulgaria | 2 | - |
| Czechoslovak Socialist Republic | 9 | 4 |
| Denmark | 5 | 5 |
| Finland | 1 | 1 |
| France | 10 | 10 |
| Germany, Federal Republic of | <u>b/</u> | <u>8^{c/}</u> |
| Hungary | 4 | 4 |
| India | 10 | 8 |
| Israel | <u>d/</u> | 5 |
| Italy | 20 | 17 |
| Japan | <u>e/</u> | 8 |
| Mexico | 2 | 1 |
| Netherlands | 9 | 9 |
| Philippines | 2 | 1 |
| Poland | 10 | 5 |
| Romania | 10 | 2 |
| Spain | 5 | 8 |
| Sweden | <u>g/</u> | 7 |
| Switzerland | 2 | - |
| Thailand | <u>h/</u> | - |
| Union of Soviet Socialist Republics | <u>g/</u> | 17 |
| United States of America | 40 | 50 |
| Yugoslavia | <u>i/</u> | 2 |
| | Sub-total | 188 |
| <u>Regional organizations</u> | | |
| Joint Institute for Nuclear Research at Dubna, Soviet Union | 3 | 1 |
| | Total | 189 |

a/ Number of awards less rejections and withdrawals. In most cases where the number of awards exceeded available fellowships, the additional awards were financed out of current and/or prior years' savings.

b/ The offer was for 300 man-months of training in 1972, of which 294 were used.

c/ Two of the eight award holders took up their studies in 1972. The continuation of their training in 1973 and the studies of other Type II award holders under the 1972 and prior years' programmes will constitute the first charge against the Government's 1973 offer.

d/ On the basis of nine man-months per fellowship, or a total of 45 man-months of training.

e/ On the basis of eight man-months per fellowship, or a total of 160 man-months of training.

f/ Eight of these were carried over from 1971; the balance will be used in 1973.

g/ Awards are made on the basis of available funds rather than a given number of openings or man-months of training.

h/ Available to candidates from the region.

i/ On the basis of six man-months per fellowship, or a total of 30 man-months of training.

ANNEX B

RESEARCH CONTRACTS

I. Total value of contracts in 1972

| Year | New contracts | Renewals | Total | Value |
|------|---------------|----------|-------|---------|
| 1971 | 76 | 118 | 194 | 698 205 |
| 1972 | 115 | 82 | 197 | 750 520 |

II. Analysis by subject matter of contracts awarded or renewed in 1972

| Subject matter of research | Number of contracts placed | Number of contracts renewed | Agency payment in dollars |
|---|----------------------------|-----------------------------|---------------------------|
| Nuclear technology | | | |
| Nuclear power and reactors | 15 | 7 | 85 350 |
| Waste management | 15 | - | 85 400 |
| Physics and chemistry | 4 | 6 | 33 550 |
| Radioisotopes and radiation applications in | | | |
| Agriculture | 38 | 16 | 169 100 |
| Food irradiation | 7 | 5 | 50 500 |
| Hydrology | 1 | 5 | 27 450 |
| Industry | 2 | 2 | 11 000 |
| Medicine | 15 | 15 | 132 125 |
| Protection of man and his environment | | | |
| Radiological safety | 6 | 11 | 73 400 |
| Radiation biology | 7 | 12 | 57 900 |
| Environmental research | - | 2 | 4 000 |
| Dosimetry | 5 | 1 | 20 745 |
| Total | 115 | 82 | 750 520 |

ANNEX C

CONFERENCES, SYMPOSIA AND SEMINARS HELD DURING THE PERIOD
1 JULY 1972-30 JUNE 1973

| Date and place | Title | Co-sponsoring organizations | Number of participants | Number of countries represented | Number of organizations represented | Number of papers presented |
|---|--|-----------------------------|------------------------|---------------------------------|-------------------------------------|----------------------------|
| <u>1972</u> | | | | | | |
| 10-14 July Seattle, United States of America | Symposium on the Interaction of Radioactive Contaminants with Constituents of the Marine Environment | | 133 | 15 | 5 | 48 |
| 31 July-4 August Helsinki | Symposium on the Use of Nuclear Techniques in the Basic Metal Industries | | 70 | 22 | 4 | 36 |
| 23-28 October Monte Carlo | Symposium on Medical Radioisotope Scintigraphy | | 488 | 40 | 5 | 97 |
| 6-10 November Teheran | Symposium on Irradiation Facilities for Research Reactors | | 81 | 20 | 2 | 34 |
| 13-17 November Bombay, India | Symposium on Radiation Preservation of Food | FAO | 106 | 29 | 4 | 50 |
| 27 November-6 December Paris | Symposium on the Management of Radioactive Wastes from Fuel Reprocessing | NEA | 239 | 26 | 7 | 46 |
| 11-15 December Vienna | Symposium on Neutron Monitoring for Radiation Purposes | | 132 | 30 | 9 | 64 |
| <u>1973</u> | | | | | | |
| 22-26 January Prague | Symposium on Nuclear Power Plants Control and Instrumentation | | 251 | 29 | 6 | 59 |
| 5-9 February Jülich, Federal Republic of Germany | Symposium on Principles and Standards of Reactor Safety | | 254 | 29 | 4 | 40 |
| 12-16 March Paris | Symposium on Applications of Nuclear Data in Science and Technology | | 207 | 30 | 5 | 72 |
| 26-30 March Copenhagen | Symposium on New Developments in Radiopharmaceuticals and Labelled Compounds | WHO | 288 | 36 | 4 | 64 |
| 14-18 May Aix-en-Provence, France | Symposium on Environmental Behaviour of Radionuclides Released in the Nuclear Industry | NEA WHO | 211 | 30 | 8 | 49 |

ANNEX D

STATUS OF FINANCIAL CONTRIBUTIONS TO THE AGENCY ON 30 JUNE 1973

1. Advances to the Working Capital Fund and contributions to the Regular Budget for 1973

| Member State | Working Capital Fund | | | Regular Budget for 1973 | | | |
|--|----------------------|---------|-------------|-------------------------|---------|-----------|-------------|
| | Assessed | Paid | Outstanding | Assessed | Credits | Paid | Outstanding |
| Afghanistan | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Albania | 800 | 800 | - | 6 307 | - | - | 6 307 |
| Algeria | 1 800 | 1 360 | 440 | 14 191 | - | - | 14 191 |
| Argentina | 16 400 | 13 090 | 3 310 | 129 666 | - | - | 129 666 |
| Australia | 28 200 | 28 200 | - | 238 313 | - | 116 447 | 121 866 |
| Austria | 10 600 | 10 600 | - | 89 579 | - | 89 579 | - |
| Belgium | 20 200 | 20 200 | - | 170 707 | - | 170 707 | - |
| Bolivia | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Brazil | 15 400 | 15 400 | - | 122 159 | - | - | 122 159 |
| Bulgaria | 3 400 | 3 400 | - | 26 615 | - | - | 26 615 |
| Burma | 1 000 | 850 | 150 | 7 884 | - | - | 7 884 |
| Byelorussian Soviet Socialist Republic | 9 600 | 9 600 | - | 81 128 | - | 39 589 | 41 539 |
| Cameroon | 800 | 800 | - | 6 307 | - | 6 307 | - |
| Canada | 59 200 | 59 200 | - | 500 289 | - | 500 289 | - |
| Chile | 3 800 | 3 060 | 740 | 30 335 | - | - | 30 335 |
| Colombia | 3 600 | 2 890 | 710 | 28 380 | - | - | 28 380 |
| Costa Rica | 800 | 800 | - | 6 307 | - | - | 6 307 |
| Cuba | 3 000 | 2 550 | 450 | 24 027 | - | - | 24 027 |
| Cyprus | 800 | 800 | - | 6 307 | - | 6 307 | - |
| Czechoslovak Socialist Republic | 17 200 | 17 200 | - | 145 354 | 170 | 145 184 | - |
| Denmark | 12 000 | 12 000 | - | 101 410 | - | 101 410 | - |
| Dominican Republic | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Ecuador | 800 | 800 | - | 6 307 | - | - | 6 307 |
| Egypt, Arab Republic of | 3 400 | 2 720 | 680 | 26 992 | - | - | 26 992 |
| El Salvador | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Ethiopia | 800 | 800 | - | 6 307 | - | 6 307 | - |
| Finland | 8 600 | 8 600 | - | 72 677 | - | 72 677 | - |
| France | 115 400 | 115 400 | - | 975 227 | - | 944 113 | 31 114 |
| Gabon | 800 | 800 | - | 6 307 | - | - | 6 307 |
| Germany, Federal Republic of | 130 800 | 130 800 | - | 1 105 370 | - | 1 105 370 | - |
| Ghana | 1 400 | 1 400 | - | 11 037 | - | 11 037 | - |
| Greece | 5 600 | 5 600 | - | 43 770 | - | 43 770 | - |
| Guatemala | 1 000 | 850 | 150 | 7 884 | - | - | 7 884 |
| Haiti | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Holy See | 800 | 680 | 120 | 6 761 | - | - | 6 761 |
| Hungary | 9 200 | 9 200 | - | 77 748 | - | 8 280 | 69 468 |
| Iceland | 800 | 680 | 120 | 6 761 | - | - | 6 761 |
| India | 29 800 | 29 800 | - | 236 436 | - | 236 436 | - |
| Indonesia | 5 400 | 5 400 | - | 43 324 | - | 6 048 | 37 276 |
| Iran | 4 200 | 3 400 | 800 | 32 922 | - | - | 32 922 |
| Iraq | 1 400 | 1 400 | - | 10 848 | - | 10 848 | - |
| Ireland | 2 800 | 2 800 | - | 23 662 | - | 23 662 | - |
| Israel | 3 800 | 3 800 | - | 32 113 | - | 32 113 | - |
| Italy | 68 000 | 68 000 | - | 574 657 | - | 574 657 | - |
| Ivory Coast | 800 | 800 | - | 6 307 | - | 6 307 | - |
| Jamaica | 800 | 800 | - | 6 496 | - | 5 640 | 856 |
| Japan | 103 800 | 103 800 | - | 877 197 | - | 877 197 | - |
| Jordan | 800 | 800 | - | 6 307 | - | 6 187 | 120 |
| Kenya | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Khmer Republic | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Korea, Republic of | 2 000 | 1 700 | 300 | 15 955 | 170 | - | 15 785 |
| Kuwait | 1 600 | 1 190 | 410 | 13 521 | - | - | 13 521 |
| Lebanon | 1 000 | 850 | 150 | 7 884 | - | - | 7 884 |
| Liberia | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Libyan Arab Republic | 1 400 | 1 020 | 380 | 11 831 | - | - | 11 831 |

| Member State | Working Capital Fund | | | Regular Budget for 1973 | | | |
|--|----------------------|-----------|-------------|-------------------------|---------|-----------|-------------|
| | Assessed | Paid | Outstanding | Assessed | Credits | Paid | Outstanding |
| Liechtenstein | 800 | 800 | - | 6 761 | - | 6 761 | - |
| Luxembourg | 1 000 | 1 000 | - | 8 451 | - | 8 451 | - |
| Madagascar | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Malaysia | 2 000 | 1 530 | 470 | 15 767 | - | - | 15 767 |
| Mali | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Mexico | 17 000 | 17 000 | - | 132 888 | - | 132 888 | - |
| Monaco | 800 | 800 | - | 6 761 | - | 6 761 | - |
| Morocco | 1 800 | 1 360 | 440 | 14 191 | - | - | 14 191 |
| Netherlands | 22 600 | 22 600 | - | 190 989 | - | 190 989 | - |
| New Zealand | 6 200 | 4 930 | 1 270 | 52 395 | - | - | 52 395 |
| Niger | 800 | 800 | - | 6 307 | - | 6 307 | - |
| Nigeria | 2 200 | 2 200 | - | 17 720 | - | 1 869 | 15 851 |
| Norway | 8 200 | 8 200 | - | 69 297 | - | 69 297 | - |
| Pakistan | 6 600 | 5 270 | 1 330 | 52 031 | - | - | 52 031 |
| Panama | 800 | 800 | - | 6 307 | - | - | 6 307 |
| Paraguay | 800 | - | 800 | 6 307 | - | - | 6 307 |
| Peru | 2 000 | 2 000 | - | 15 579 | - | - | 15 579 |
| Philippines | 6 000 | 4 760 | 1 240 | 47 489 | - | - | 47 489 |
| Poland | 27 000 | 27 000 | - | 212 477 | - | 102 759 | 109 718 |
| Portugal | 3 000 | 2 550 | 450 | 23 462 | - | - | 23 462 |
| Romania | 7 000 | 7 000 | - | 54 808 | - | 26 539 | 28 269 |
| Saudi Arabia | 1 400 | 1 400 | - | 10 720 | - | 10 720 | - |
| Senegal | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Sierra Leone | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Singapore | 1 000 | 1 000 | - | 7 884 | - | 7 884 | - |
| South Africa | 10 400 | 10 400 | - | 81 046 | - | 81 046 | - |
| Spain | 20 000 | 20 000 | - | 154 465 | - | 154 465 | - |
| Sri Lanka | 1 000 | 850 | 150 | 7 884 | - | - | 7 884 |
| Sudan | 800 | 680 | 120 | 6 496 | - | - | 6 496 |
| Sweden | 24 000 | 24 000 | - | 202 820 | - | 202 820 | - |
| Switzerland | 16 200 | 16 200 | - | 136 903 | - | 136 903 | - |
| Syrian Arab Republic | 800 | 800 | - | 6 307 | - | - | 6 307 |
| Thailand | 2 400 | 2 400 | - | 18 920 | - | 18 920 | - |
| Tunisia | 800 | 800 | - | 6 307 | - | 6 307 | - |
| Turkey | 6 800 | 5 440 | 1 360 | 53 231 | - | - | 53 231 |
| Uganda | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Ukrainian Soviet Socialist Republic | 36 000 | 36 000 | - | 304 230 | - | 148 565 | 155 665 |
| Union of Soviet Socialist Republics | 272 600 | 272 600 | - | 2 303 698 | - | 1 125 114 | 1 178 584 |
| United Kingdom of Great Britain and Northern Ireland | 113 400 | 113 400 | - | 958 325 | - | 958 325 | - |
| United States of America | 630 400 | 535 840 | 94 560 | 5 327 407 | - | - | 5 327 407 |
| Uruguay | 1 400 | 1 020 | 380 | 11 225 | - | - | 11 225 |
| Venezuela | 7 800 | 7 800 | - | 61 869 | - | - | 61 869 |
| Viet-Nam | 1 400 | 1 020 | 380 | 10 848 | - | - | 10 848 |
| Yugoslavia | 7 200 | 7 200 | - | 56 761 | - | 13 252 | 43 509 |
| Zaire, Republic of | 800 | 680 | 120 | 6 496 | - | - | 6 496 |
| Zambia | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| Sub-total | 2 000 000 | 1 886 340 | 113 660 | 16 750 000 | 340 | 8 563 410 | 8 186 250 |
| Bangladesh ^{a/} | 800 | 680 | 120 | 6 307 | - | - | 6 307 |
| TOTAL | 2 000 800 | 1 887 020 | 113 780 | 16 756 307 | 340 | 8 563 410 | 8 192 557 |

^{a/} Bangladesh became a Member on 27 September 1972.

2. Outstanding contributions to the Regular Budget for the years 1958-1972

| State | 1958-1963 ^{a/} | 1964 | 1965 | 1966 ^{b/} | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | Total |
|-------------------------|-------------------------|-----------|-----------|--------------------|-----------|------------|------------|------------|------------|------------|-------------|
| Afghanistan | - | 3 343 | 3 857 | 4 333 | 4 587 | 5 082 | 4 155 | 4 741 | 5 221 | 5 934 | 41 253 |
| Albania | - | - | - | - | - | - | - | - | - | 120 | 120 |
| Bolivia | - | - | - | - | 1 802 | 4 040 | 4 355 | 4 741 | 5 221 | 5 934 | 26 093 |
| Brazil | - | - | - | - | - | - | - | - | 55 955 | 109 796 | 165 751 |
| Bulgaria | - | - | - | - | - | - | - | - | - | 680 | 680 |
| Chile | - | - | - | - | - | - | - | - | 18 601 | 27 267 | 45 868 |
| China ^{c/} | - | - | - | - | - | - | - | 353 332 | 472 482 | 539 580 | 1 365 394 |
| Colombia | - | - | - | - | - | - | - | - | - | 25 236 | 25 236 |
| Costa Rica | - | - | - | - | - | - | - | - | - | 1 526 | 1 526 |
| Cuba | - | - | - | - | - | - | - | - | - | 19 058 | 19 058 |
| Dominican Republic | 6 576 | 3 610 | 3 857 | 3 467 | 3 670 | 4 065 | 4 355 | 4 741 | 5 221 | 5 934 | 45 496 |
| Ecuador | - | - | - | - | - | - | 1 181 | 4 741 | 5 221 | 5 934 | 17 077 |
| Egypt | - | - | - | - | - | - | - | - | - | 22 542 | 22 542 |
| El Salvador | - | - | - | - | - | - | 4 124 | 4 741 | 5 221 | 5 934 | 20 020 |
| Gabon | - | - | - | - | - | - | - | - | - | 82 | 82 |
| Guatemala | - | - | - | - | - | - | - | 4 400 | 6 526 | 7 417 | 18 343 |
| Haiti | 12 326 | 2 888 | 3 085 | 3 467 | 3 670 | 4 065 | 4 355 | 4 741 | 5 221 | 5 934 | 49 752 |
| Honduras ^{d/} | - | 2 020 | 3 085 | 3 467 | 3 670 | - | - | - | - | - | 12 242 |
| Khmer Republic | - | - | - | - | - | - | - | - | - | 132 | 132 |
| Liberia | - | - | - | - | - | - | - | 871 | 5 221 | 5 934 | 12 026 |
| Mali | - | - | - | - | 2 322 | 4 065 | 4 355 | 4 741 | 5 221 | 5 934 | 26 638 |
| Nicaragua ^{e/} | - | - | - | - | - | - | - | 3 707 | - | - | 3 707 |
| Panama | - | - | - | - | - | - | - | - | - | 833 | 833 |
| Paraguay | 14 031 | 2 888 | 3 085 | 3 467 | 3 670 | 4 065 | 4 355 | 4 741 | 5 341 | 5 934 | 51 577 |
| Peru | - | - | - | - | - | - | - | - | 5 857 | 13 351 | 19 208 |
| Senegal | - | - | - | - | - | - | - | - | - | 5 420 | 5 420 |
| Sierra Leone | - | - | - | - | - | - | - | - | - | 4 734 | 4 734 |
| Syrian Arab Republic | - | - | - | - | - | - | - | - | - | 1 095 | 1 095 |
| Uganda | - | - | - | - | - | - | - | 4 507 | 5 221 | 5 934 | 15 662 |
| Uruguay | - | - | - | - | - | - | - | - | 10 102 | 9 277 | 19 379 |
| Venezuela | - | - | - | - | - | - | - | 12 950 | 53 513 | 55 640 | 122 103 |
| Zaire, Republic of | - | - | - | - | - | - | - | - | 5 897 | 6 123 | 12 020 |
| Zambia | - | - | - | - | - | - | 3 717 | 4 741 | 5 221 | 5 934 | 19 613 |
| Total outstanding | 32 933 | 14 749 | 16 969 | 18 201 | 23 391 | 25 382 | 34 952 | 422 436 | 686 484 | 915 183 | 2 190 680 |
| Total paid | 35 183 839 | 7 215 525 | 7 715 313 | 8 659 358 | 9 161 619 | 10 146 248 | 10 876 501 | 11 448 344 | 12 660 175 | 14 482 751 | 127 549 673 |
| Total assessed | 35 216 772 | 7 230 274 | 7 732 282 | 8 677 559 | 9 185 010 | 10 171 630 | 10 911 453 | 11 870 780 | 13 346 659 | 15 397 934 | 129 740 353 |
| % of assessment | 99,91 | 99,80 | 99,78 | 99,79 | 99,75 | 99,75 | 99,67 | 96,44 | 94,86 | 94,06 | 98,31 |

a/ See part 3 below.

b/ Includes supplementary assessment.

c/ The entries in respect to China refer to actions taken prior to 9 December 1971 by the authorities representing China in the Agency at the time of these actions.

d/ Withdrew from membership on 19 June 1967.

e/ Withdrew from membership on 14 December 1970.

3. Summary of outstanding contributions for the years 1958-1963

| | <u>1958</u> | <u>1959</u> | <u>1960</u> | <u>1961</u> | <u>1962</u> | <u>1963</u> | <u>Total</u> |
|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| Dominican Republic | - | - | - | - | 3 015 | 3 561 | 6 576 |
| Haiti | - | 2 021 | 2 337 | 2 467 | 2 652 | 2 849 | 12 326 |
| Paraguay | 1 636 | 2 090 | 2 337 | 2 467 | 2 652 | 2 849 | 14 031 |
| Total outstanding | 1 636 | 4 111 | 4 674 | 4 934 | 8 319 | 9 259 | 32 933 |
| Total paid | 4 113 124 | 5 220 889 | 5 876 306 | 6 195 756 | 6 631 760 | 7 146 004 | 35 183 839 |
| Total assessed | 4 114 760 | 5 225 000 | 5 880 980 | 6 200 690 | 6 640 079 | 7 155 263 | 35 216 772 |
| % of assessment | 99.96 | 99.92 | 99.92 | 99.92 | 99.87 | 99.80 | 99.91 |

4. Voluntary contributions to the General Fund for 1972 and 1973

(Expressed in United States dollars at the rate of exchange used for the United Nations Development Programme)

| Member State | 1972 | | | 1973 | | |
|--|----------------------|--------|-------------|----------------------|--------|-------------|
| | Pledged | Paid | Outstanding | Pledged | Paid | Outstanding |
| Aghanistan | - | - | - | - | - | - |
| Albania | 800 ^{a/} | - | 800 | - | - | - |
| Algeria | 2 400 | 2 400 | - | 2 700 | 2 700 | - |
| Argentina | 23 100 | - | 23 100 | 24 600 | - | 24 600 |
| Australia | 30 000 ^{a/} | 30 000 | - | 42 300 | 30 000 | 12 300 |
| Austria | 15 000 | 15 000 | - | 15 900 | 15 900 | - |
| Bangladesh | - | - | - | - | - | - |
| Belgium | 20 000 ^{a/} | 20 000 | - | 25 000 ^{b/} | 25 000 | - |
| Bolivia | - | - | - | - | - | - |
| Brazil | 21 900 | 21 900 | - | 30 000 | - | 30 000 |
| Bulgaria | 4 000 ^{a/} | 4 000 | - | 4 324 ^{b/} | - | 4 324 |
| Burma | 1 000 ^{a/} | 1 000 | - | - | - | - |
| Byelorussian Soviet Socialist Republic | - | - | - | - | - | - |
| Cameroon | 1 200 | 1 200 | - | 1 200 | 200 | 1 000 |
| Canada | 70 000 ^{a/} | 70 000 | - | 88 800 | - | 88 800 |
| Chile | 5 400 | - | 5 400 | 1 000 ^{b/} | - | 1 000 |
| Colombia | - | - | - | - | - | - |
| Costa Rica | 800 ^{a/} | - | 800 | - | - | - |
| Cuba | 4 500 | 4 500 | - | 4 500 | 4 500 | - |
| Cyprus | 1 200 | 1 200 | - | 1 200 | 1 200 | - |
| Czechoslovak Socialist Republic | 20 833 ^{a/} | 20 833 | - | 27 778 | 27 778 | - |
| Denmark | 16 800 | 16 800 | - | 18 000 | 18 000 | - |
| Dominican Republic | - | - | - | - | - | - |
| Ecuador | - | - | - | - | - | - |
| Egypt, Arab Republic of | 11 500 | 11 500 | - | 12 778 | 12 778 | - |
| El Salvador | - | - | - | - | - | - |
| Ethiopia | - | - | - | - | - | - |
| Finland | 12 300 | 12 300 | - | 12 900 | 12 900 | - |
| France | 30 213 ^{a/} | 30 213 | - | 70 740 ^{b/} | 70 740 | - |
| Gabon | - | - | - | - | - | - |

| Member State | 1972 | | | 1973 | | |
|------------------------------|----------------------|---------|-------------|----------------------|---------|-------------|
| | Pledged | Paid | Outstanding | Pledged | Paid | Outstanding |
| Germany, Federal Republic of | 185 400 | 185 400 | - | 196 200 | 196 200 | - |
| Ghana | 2 000 | 2 000 | - | 2 200 | 2 200 | - |
| Greece | 7 800 | 7 800 | - | 8 400 | - | 8 400 |
| Guatemala | - | - | - | - | - | - |
| Haiti | - | - | - | - | - | - |
| Holy See | 3 000 | 3 000 | - | 3 000 | - | 3 000 |
| Hungary | 12 667 ^{a/} | 12 667 | - | 14 115 | 14 115 | - |
| Iceland | - | - | - | - | - | - |
| India | 42 500 | 42 500 | - | 45 000 | 43 099 | 1 901 |
| Indonesia | 7 500 | 7 500 | - | 8 100 | 600 | 7 500 |
| Iran | 5 000 ^{a/} | 5 000 | - | 6 300 | - | 6 300 |
| Iraq | 1 800 | 1 800 | - | - | - | - |
| Ireland | 4 200 | 4 200 | - | 4 200 | 4 200 | - |
| Israel | 5 400 | 5 400 | - | 5 700 | 5 700 | - |
| Italy | 80 500 ^{a/} | 80 500 | - | 96 600 ^{b/} | 96 600 | - |
| Ivory Coast | 929 ^{a/} | 929 | - | 680 ^{b/} | 680 | - |
| Jamaica | - | - | - | - | - | - |
| Japan | 147 300 | 147 300 | - | 155 700 | 155 700 | - |
| Jordan | 800 ^{a/} | - | 800 | - | - | - |
| Kenya | - | - | - | - | - | - |
| Khmer Republic | - | - | - | - | - | - |
| Korea, Republic of | 3 000 | 3 000 | - | 3 000 ^{b/} | - | 3 000 |
| Kuwait | 2 100 | 2 100 | - | 1 500 ^{b/} | - | 1 500 |
| Lebanon | 1 500 | 1 500 | - | - | - | - |
| Liberia | - | - | - | - | - | - |
| Libyan Arab Republic | - | - | - | - | - | - |
| Liechtenstein | 1 000 ^{a/} | 1 000 | - | 1 200 | 1 200 | - |
| Luxembourg | - | - | - | - | - | - |
| Madagascar | 1 000 ^{a/} | 1 000 | - | 1 200 | - | 1 200 |
| Malaysia | - | - | - | - | - | - |
| Mali | - | - | - | - | - | - |
| Mexico | 24 000 | 24 000 | - | 25 500 | 25 500 | - |
| Monaco | 2 000 | 2 000 | - | 2 000 | 2 000 | - |
| Morocco | 1 813 ^{a/} | 1 813 | - | - | - | - |
| Netherlands | 40 000 | 40 000 | - | 40 000 | 40 000 | - |
| New Zealand | 6 600 ^{a/} | 6 600 | - | - | - | - |
| Niger | 1 200 | 1 200 | - | - | - | - |
| Nigeria | - | - | - | - | - | - |
| Norway | 11 700 | 11 700 | - | 12 300 ^{b/} | 12 300 | - |
| Pakistan | 8 250 ^{a/} | 8 250 | - | 8 250 ^{b/} | 8 250 | - |
| Panama | 1 000 | 1 000 | - | - | - | - |
| Paraguay | - | - | - | - | - | - |
| Peru | 2 250 ^{a/} | 1 500 | 750 | - | - | - |
| Philippines | 8 000 ^{a/} | 8 000 | - | 8 000 ^{b/} | 8 000 | - |
| Poland | 11 322 ^{a/} | 11 322 | - | 15 060 ^{b/} | 15 060 | - |
| Portugal | 4 500 | 4 500 | - | 4 500 | - | 4 500 |
| Romania | 9 900 | 9 900 | - | 10 500 | 5 250 | 5 250 |
| Saudi Arabia | 2 000 | 2 000 | - | 2 100 | 2 000 | 100 |
| Senegal | - | - | - | - | - | - |
| Sierra Leone | - | - | - | - | - | - |
| Singapore | 1 500 | 1 500 | - | 1 500 | 1 500 | - |
| South Africa | 14 700 | 14 700 | - | 15 600 | 15 600 | - |
| Spain | 28 500 | 28 500 | - | 30 000 ^{b/} | 30 000 | - |
| Sri Lanka | 1 250 ^{a/} | 1 250 | - | 1 250 ^{b/} | - | 1 250 |
| Sudan | - | - | - | 1 200 | - | 1 200 |

| Member State | 1972 | | | 1973 | | |
|---|------------------------|------------------|---------------|------------------------|------------------|------------------|
| | Pledged | Paid | Outstanding | Pledged | Paid | Outstanding |
| Sweden | 34 200 | 34 200 | - | 36 000 | 36 000 | - |
| Switzerland | 22 800 | 22 800 | - | 24 300 | 24 300 | - |
| Syrian Arab Republic | - | - | - | - | - | - |
| Thailand | 4 000 | 4 000 | - | 4 000 | 4 000 | - |
| Tunisia | - | - | - | - | - | - |
| Turkey | 8 000 ^{a/} | 8 000 | - | 10 200 | 10 200 | - |
| Uganda | - | - | - | - | - | - |
| Ukrainian Soviet Socialist Republic | - | - | - | - | - | - |
| Union of Soviet Socialist Republics | 304 078 ^{a/} | 304 078 | - | 426 829 | 303 398 | 123 431 |
| United Kingdom of Great Britain and Northern Ireland | 160 800 | 160 800 | - | 170 100 | - | 170 100 |
| United States of America | 945 600 ^{cd/} | 945 600 | - | 945 600 ^{cd/} | - | 945 600 |
| Uruguay | 1 800 | - | 1 800 | - | - | - |
| Venezuela | - | - | - | - | - | - |
| Viet-Nam | 1 800 | 1 800 | - | - | - | - |
| Yugoslavia | 9 000 ^{a/} | 9 000 | - | 9 000 ^{b/} | - | 9 000 |
| Zaire, Republic of | 1 200 | - | 1 200 | 2 000 | - | 2 000 |
| Zambia | - | - | - | - | - | - |
| TOTAL | 2 482 105 | 2 447 455 | 34 650 | 2 742 604 | 1 285 348 | 1 457 256 |

- a/ Pledge is less than the Member's Regular Budget assessment ratio (GC(XV)/RES/284) applied to the target of \$3 million for voluntary contributions set by Resolution GC(XV)/RES/281, para. 1.
- b/ Pledge is less than the Member's Regular Budget assessment ratio (GC(XVI)/RES/295) applied to the target of \$3 million for voluntary contributions set by Resolution GC(XVI)/RES/293, para. 1.
- c/ When making this pledge, the United States also pledged itself to make contributions in kind in the form of cost-free experts, equipment for technical assistance, laboratory equipment, special nuclear materials and Type II fellowships, to a total value of \$664 000 in 1972 and approximately \$804 000 for the year 1973. 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 last year (GC(XVII)/504, Schedule G).
- d/ The United States pledged a sum equal to its share of the target at its base rate of assessment, provided that its contribution would not exceed 40% of the total unrestricted cash contributions of all Member States made during the 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 |
| Austria ^{c/} | SAR | Graz | Argonaut | .00 | x |
| | TRIGA-VIENNA | Vienna | Triga II | .25 | x |
| | ASTRA | Scibersdorf | 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 |
| 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 | Vochoz | CA | .00 | x |
| | VVR-S | Rez | Tank | 4.00 | x |
| | TR-O | Rez | CA | .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) | Rosendorf | Tank | 6.00 | x |
| | Rake II | Rosendorf | Critical Ass. | .00 | x |
| | RRR | Rosendorf | Critical Ass. | .00 | x |
| Greece ^{c/} | GRR-1 | Athens | Pool | 5.00 | x |
| Hungary ^{c/} | WWR-SM | Budapest | Tank | 5.00 | x |
| | ZR-4 | Budapest | CA | .00 | x |
| | ZR-6 | Budapest | CA | .00 | x |
| | Training reactor | Budapest | Tank | .01 | x |
| Indonesia | PRAP (TRIGA II) | Bandung | Triga II | 1.00 | x |
| Iran ^{c/} | UTRR | Teheran | Pool | 5.00 | x |
| Iraq ^{c/} | IRT-2000 | Baghdad | Pool | 2.00 | x |

| State | Abbreviated name of reactor | Location | Type | Capacity MW(th) | In operation |
|---------------------------|-------------------------------|----------------------|-----------------------------|-----------------|--------------|
| Israel | IRR-1 | Soreq | Pool | 5.00 | x |
| Japan | AHCF | Tokai-Mura | Crit. Fac. | .00 | x |
| | DCA | Oarai-Machi | Crit. Fac. | .00 | x |
| | FCA | Tokai-Mura | Crit. Fac. | .01 | x |
| | HCA | Kawasaki-shi | Crit. Fac. | .00 | x |
| | HTR | Kawasaki-shi | Pool | .10 | x |
| | JMTR | Oarai-Machi | Tank | 50.00 | x |
| | JMTR-CA | Oarai-Machi | Crit. Fac. | .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 |
| | MCF | Ohmiya | Crit. Fac. | .00 | x |
| | Musashi College of Technology | Kawasaki-shi | Triga II | .10 | x |
| | NAIG-CA | Kawasaki-shi | Crit. Fac. | .00 | x |
| | Rikkyo University | Nagasaka | Triga II | .10 | x |
| | SHCA | Tokai-Mura | Crit. Fac. | .00 | x |
| | TCA | Tokai-Mura | Crit. Fac. | .00 | x |
| | TODAI | Tokai-Mura | Fast Neutron Source Reactor | .002 | x |
| TRR | Kawasaki-shi | Pool | .10 | 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 | CA | .00 | x |
| | Anna | Świerk | CA | .00 | x |
| | Agata | Świerk | CA | .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 Crit. Fac. | .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 |
| | KRITZ | Studsvik | Tank | .00 | x |
| | R-0 | Studsvik | Pool | .00 | x |
| Switzerland | Proteus | Würenlingen | Fast thermal CA | .00 | x |
| | Saphir | Würenlingen | Pool | 5.00 | x |
| | Diorit | Würenlingen | HW | 30.00 | x |
| | Crocus | Lausanne | CA | .00 | x |
| | AGN201P | Geneva | Solid homogeneous | .00 | x |
| | AGN211P | Basel | Pool | .00 | x |
| Thailand | TR-1 | Bangkok | Pool | 1.00 | x |
| Turkey | TR-1 | Istanbul | Pool | 1.00 | x |
| United Kingdom | Zebra | Winfrith | Crit. Fac. | .00 | x |

| State | Abbreviated name of reactor | Location | Type | Capacity MW(th) | In operation |
|----------------------------------|-----------------------------|------------|-------------|-----------------|--------------|
| 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 | Crit. Fac. | .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 | - |
| Canada ^{c/} | Pickering | Pickering, Ontario | Candu | 2032 | x |
| | NPD | Ralphton, Ontario | Candu | 22 | x |
| | Gentilly | Gentilly, Quebec | Candu | 250 | x |
| | DPGS | Kincardine, Ontario | Candu | 208 | x |
| Czechoslovak Socialist Republic ^{c/} | A 1 | Bohunice | HWGC | 110 | x |
| German Democratic Republic ^{c/} | Rheinsberg PWR | Rheinsberg | PWR | 80 | x |
| | Greifswald PWR | Greifswald | PWR | 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-Fukui | PWR | 340 | x |
| | Mihama-2 | Mihama-Fukui | PWR | 500 | x |
| | Fukushima-1 | Okuma-Fukushima | BWR | 460 | x |
| | Fukushima-2 | Okuma-Fukushima | BWR | 784 | - |
| | "Mutsu" Nuclear Ship | Minato-Machi Mutsu | PWR | 36 | x |
| | Shimane | Kashima-cho | BWR | 460 | - |
| Pakistan | KANUPP | Karachi | Candu | 125 | x |
| Spain | "José Cabrera" | Almonacid de Zorita | PWR | 153 | x |
| | Santa Maria de Garona | Province of Burgos | BWR | 440 | x |
| Sweden | Ågesta | Stockholm | PHWR | 12 | x |
| | Oskarshamn I | Oskarshamn | BWR | 440 | x |
| | Ringhals I | near Göteborg | BWR | 760 | - |
| 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 Pilot Fuel Fabrication Plant, Constituyentes |
| Brazil | Fabrication Facility, Metallurgy Department, 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 |
| Czechoslovak Socialist Republic ^{c/} | Uranium Industry Chemical Plant - Metallurgical Pilot Plant, Mydlovary Nuclear Fuel Institute, Zbraslav |
| Denmark ^{c/} | Metallurgy Department, Risø |
| 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. |
| Norway ^{c/} | Fuel Element Pilot Production Plant, Kjeller |
| Spain | Pilot Reprocessing Plant, Juan Vigon Research Centre, Madrid Metallurgical Plant, Juan Vigon Research Centre, Madrid |
| 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.

