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REPORT OF THE INTERNATIONAL ATOMIC ENERGY AGENCY

Note by the Secretary-General

1. The sixteenth report of the International Atomic Energy Agency, for the year ending 30 June 1972, is submitted herewith to the General Assembly. Major developments since this report was published will be covered by the annual statement of the Director-General of the Agency to the General Assembly. This report has been transmitted in accordance with the provision of Article III.1 (a) of the Agreement governing the relationship between the United Nations and the International Atomic Energy Agency. 1/

2. As only a limited number of copies of this report are available, it has not been possible to make a full distribution. Delegations are therefore requested to have the copies transmitted to them available during the discussion of this item.

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* A/8760.

1/ General Assembly resolution 1145 (XII), annex.

ANNUAL REPORT

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INTERNATIONAL ATOMIC ENERGY AGENCY

CONTENTS

ANNEXES

List of abbreviations

ACABQ	Advisory Committee on Administrative and Budgetary Questions
Agency	International Atomic Energy Agency
ECOSOC	Economic and Social Council of the United Nations
EURATOM	European Atomic Energy Community
EXFOR	Exchange Format for Nuclear Data
FAO	Food and Agriculture Organization of the United Nations
IAEA	International Atomic Energy Agency
IAKW	Internationale Amtssitz- und Konferenzzentrum Wien AG
IBRD	International Bank for Reconstruction and Development
ILO	International Labour Organisation
IMCO	Inter-Governmental Maritime Consultative Organization
INIS	International Nuclear Information System
MHD	Magnetohydrodynamic
NEA	Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (formerly ENEA)
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
OPANAL	Organization for the Prohibition of Nuclear Weapons in Latin America
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)
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. The main themes of the Agency's work during the twelve months covered by this report have been:

(a) The negotiation of safeguards agreements with States in connection with the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[1];

(b) Assistance to developing countries, particularly for the introduction of nuclear power and the use of nuclear techniques in agriculture; and

(c) The effect of nuclear energy on the environment.

2. The major scientific event of the year for the Agency was the Fourth International Conference on the Peaceful Uses of Atomic Energy at Geneva in September 1971. The discussions showed the extent to which nuclear power has become an ordinary commercial enterprise since the third Conference in 1964, as well as a feature of the energy plans of many developing countries.

The Treaty on the Non-Proliferation of Nuclear Weapons

3. Table 20 shows the States that had signed, ratified or acceded to NPT by 30 June 1972 and the progress they had made in negotiating the safeguards agreements with the Agency that are required by NPT. The Board of Governors of the Agency has approved agreements with 25 of the 68 non-nuclear-weapon States that had become party to NPT by that date; these agreements cover nearly all the non-nuclear-weapon States party to NPT that at present have significant nuclear activities or quantities of nuclear material.

4. Negotiation of such an agreement with EURATOM and the five Members of EURATOM that have signed the Treaty (Belgium, the Federal Republic of Germany, Italy, Luxembourg and the Netherlands) began in November 1971 and was nearing completion by 30 June 1972.

5. Consultations have also taken place with the Governments of the United Kingdom of Great Britain and Northern Ireland and the United States of America in regard to their offers to place certain of their nuclear activities under safeguards.

6. The Treaty for the Prohibition of Nuclear Weapons in Latin America (the Tlatelolco Treaty) was in force between 19 States on 30 June 1972. For States party both to the Tlatelolco Treaty and to NPT, safeguards will be applied under a single set of comprehensive arrangements which will satisfy the requirements of both Treaties.

Technical co-operation activities

7. The total resources of the Agency for technical co-operation activities have grown from $3 907 000 in 1970 to an estimated $6 720 000 in 1972. These figures include an estimate of the value of assistance resulting from gifts in kind. Much of the growth is accounted for by an increase in the funds allotted to countries by UNDP for nuclear energy activities.

8. The increase in the real value of the resources available is substantially less than the monetary increase because of inflation and changing exchange rates. The Agency's own programme, despite an expansion in the value of assistance being provided ($2 123 000 in 1972 compared with $1 250 000 in 1970), is not keeping pace with

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[1] Reproduced in document INFCIRC/140.

the growth in Member States' needs, the percentage of requests that could be met having dropped considerably between 1971 and 1972. The Board hopes that the overall expansion in resources available to the Agency for technical co-operation will continue.

9. The number of large-scale projects [2] that the Agency is executing for UNDP has increased from three in 1971 to nine in 1972. The Board considers that this increase is to some extent a reflection of the growing ability of nuclear energy centres in developing countries to make a direct contribution to industrial and economic growth.

10. In response to wishes expressed by the Agency's General Conference [3] in 1971, the Secretariat has begun a detailed survey of the market for nuclear power in selected developing countries during the next 5-15 years. The total cost of the survey will be about $400 000. The Board wishes to express its appreciation to the Member States concerned and to IBRD for the help that they are giving the Agency in carrying out this project. It is hoped that the survey will help developing countries to plan their programmes, the nuclear manufacturing industry to gauge and adapt itself to the market and financing institutions to estimate investment needs.

11. The Agency has, of course, the pre-eminent interest within the United Nations family in the effects on the environment of peaceful uses of nuclear energy and, in particular, in questions arising out of the disposal of radioactive waste. This interest was brought to the notice of the United Nations Conference on the Human Environment in Stockholm in June 1972, and the Conference was also fully informed about the Agency's past, present and future work on this subject. The technical and public information activities of the Agency relating to the protection of the environment are being further expanded to ensure that interested specialists, such as electricity supply commissions and utility operators, and the general public as well are kept fully and currently informed as relevant scientific research, data collection and regulatory activities are expanded.

12. The agricultural applications of nuclear techniques under the Agency's programmes have led to the release to farmers of new varieties of rice seed (radiation-induced mutants) and the demonstration of the effectiveness of radiation-attenuated vaccines in sheep rearing. A major project for using induced-mutant seed to improve the protein content of stable crops and to produce disease-resistant varieties has been successfully launched during the year.

13. In March 1972 the Board agreed that the scope of subjects covered by INIS should be expanded to cover the full range of nuclear information. INIS is thus emerging from the experimental into the fully operational stage, and a co-operative world-wide system for collecting and processing new information on nuclear science and technology will henceforth be in operation for use by all Member States. The operation of the system is to be reviewed during 1975.

Composition of the Board of Governors

14. By 30 June 1972 the Agency had been informed by the depositary Government for the Statute that 35 Members had accepted the amendment of Article VI of the Statute which the General Conference approved in 1970 [4]. The amendment, which will increase the size of the Board by about a third [5] and provide for more ample representation of the developing Members, will come into force when it has been accepted by two-thirds of the membership.

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[2] Former "Special Fund"-type projects.

[3] See Resolution GC(XV)/RES/285.

[4] By Resolution GC(XIV)/272.

[5] The size of the Board may change from time to time with changes in the relative advancement of certain Members in the technology of atomic energy. At present it is 25.

Questions of particular interest to the United Nations

15. The present annual report of the Board to the General Conference is also the Agency's report to the General Assembly of the United Nations and to ECOSOC. The remaining paragraphs of this Introduction therefore draw special attention to matters in which the General Assembly or ECOSOC have shown a particular interest.

16. A large part of the report is relevant to the General Assembly's interest in the implementation of the recommendations made in 1968 by the Conference of Non-Nuclear-Weapons States notably paragraphs 21-29 on technical co-operation, paragraphs 13 and 14 above on INIS and the composition of the Board respectively, paragraphs 75-90 on nuclear technology, paragraphs 105-118 on nuclear science information, and paragraphs 119-137 on safeguards and NPT.

17. By Resolution 2825 A (XXVI), the General Assembly requested the Agency to include in its annual report full information on the progress of its work on the application of safeguards in connection with NPT, including safeguards on nuclear material in uranium enrichment plants. Detailed information on safeguards in connection with NPT is given in paragraphs 119-122 below, the question of safeguarding nuclear material in enrichment plants being referred to in paragraphs 130-134.

18. By Resolution 2829 (XXVI) the General Assembly, among other things, commended the Agency for its intensive work on problems in connection with nuclear explosions for peaceful purposes, requested the Agency to continue these activities and "to study ways and means of establishing within its framework a service for nuclear explosions for peaceful purposes under appropriate international control". The steps that have recently been taken in this latter direction are briefly described in paragraph 89 below.

19. When ACABQ met at the Agency's Headquarters in May 1971, it was given a full opportunity to review co-ordination problems arising out of the Agency's work and the means that have been found to resolve them. ECOSOC's attention is therefore invited to ACABQ's report on the Agency contained in United Nations document A/8447/Rev. 1.

20. During the past year the only significant co-ordination problems for the Agency that have arisen are those relating to the impact on the environment of the use of nuclear energy. While technical co-operation between the Agency and UNSCEAR is close and effective, the General Assembly's decision that UNSCEAR should pay more attention to the effects of the peaceful use of nuclear energy [6] has led to some concern in the Board, and indeed at the twenty-sixth session of the General Assembly itself [7]. With regard to the broader question of co-ordination in environmental matters, the Board considers it opportune to reaffirm the view it expressed to ECOSOC in 1971 that "with regard to the impact of nuclear energy on the environment, it is clear that no new international machinery is required"[8].

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[6] See Resolution 2623 (XXV).

[7] See United Nations document A/8484, para. 5.

[8] INFCIRC/146, para. 45.

THE AGENCY'S ACTIVITIES

TECHNICAL CO-OPERATION

General

21. In 1971, 5.6 million dollars were available for technical assistance and training compared to 3.9 million dollars in 1970. A breakdown for the years 1970 and 1971 and estimates for 1972 are given in Table 1 below.

Table 1

Technical co-operation resources

	1970	1971	1972
	(in thousands of dollars)		
Regular programme	1749	2214	2300
UNDP) UNDP(SF)[a]	38[b]	861	3320
UNDP) UNDP(TA)[a]	1127	1132	
Assistance in kind (estimated value)	993	1423	1100
	3907	5630	6720

a/ On 1 January 1972 the "Special Fund" and "Technical Assistance" components ceased to exist as separate components. "Special Fund"-type projects are now referred to as "large-scale" projects.

b/ In last year's report the amount shown in respect of UNDP(SF), namely $666 000, was based on allocations received in 1970. This figure has since been corrected to correspond to revised expenditure targets, thus resulting in a lower amount.

22. The status of voluntary contributions to the General Fund for the years 1961-1971 and estimates for 1972 are shown in Table 2 below.

Table 2

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
1961	1.8	1 261 200	70.1	538 800	37 of 77	48.1
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	2 151 375	86.1	348 625	72 of 102	70.6
1972[a/]	3.0	2 290 004	76.3	709 996	67 of 102	65.7

a/ As at 30 June 1972.

Experts and equipment

23. As shown in Table 3 below, the value of approved requests for experts and equipment under the Agency's regular programme increased from $1 250 000 in 1970 to $2 123 600 in 1972 and from 36.8% to 40.3% of the aid requested in this form. The nominal value of the 1972 programme is 70% greater than it was in 1970, but part of this increase has been absorbed by higher costs; UNDP estimates that the cost of project implementation has increased at an annual rate of 6-7% in recent years. It will also be seen that the percentage of Member States' requests that can be met under this programme is estimated to drop from 52.5% in 1971 to 40.3% in 1972.

Table 3

Experts and equipment: 1967-1972

Year	Value of requests received (in thousands of dollars)	Value of assistance approved (in thousands of dollars)	Percentage of requests met
1967	2600	975.0	37.5
1968	3600	977.0	27.1
1969	3700	977.0	26.4
1970	3400	1250.0	36.8
1971	3600	1891.0	52.5
1972	5268	2123.6	40.3

24. Other developments in the regular programme are described below:

(a) The share of resources allocated to equipment rose from 20% in 1967 to 29% in 1971, and to 30% in 1972. This rise was due in part to increased contributions of equipment from certain Member States;

(b) The number of Member States receiving experts or equipment, or both, rose from 37 in 1967 to 55 in 1972; and

(c) In the 1972 programme 44 requests were found to be technically sound but could not be met because of lack of funds (which may be compared with 44 in 1970 and 27 in 1971). As is customary, these requests were brought to the attention of technically advanced Member States.

Training

25. Trends in fellowship awards over the period 1967-1972 are shown in the following table:

Table 4

Distribution of fellowship awards

Type of fellowship	1967	1968	1969	1970	1971	1972[a/]
Type I	113	121	118	159	155	105
Type II	138	148	146	163	200	153
UNDP)(SF)	-	-	1	6	8	30
UNDP)(TA)	18	46	30	34	21	
TOTAL	269	315	295	362	384	288

a/ Fellowships awarded by 30 June 1972, at which date most of the awards for the year will have been made. The figures given for preceding years cover in each case the complete year. It should be noted further that the figures for 1970-1972 do not include fellowships for study at the International Centre for Theoretical Physics at Trieste.

26. A list of the fellowships made available to the Agency free of charge by Member States in 1971 is given in Annex B. Some of the Type II fellowship openings were carried over from a previous year's offer.

27. Since the funds available from UNDP for regional and interregional projects have been sharply curtailed, it has been necessary to increase the share of 1972 regular programme resources that is to be devoted to training. Thus, all but one of the 1972 training courses will have to be financed from the regular programme.

28. Table 5 below give an analysis of the 17 training courses, three study tours (seminars) and three demonstration projects that the Agency arranged in 28 countries from mid-1971 to mid-1972.

Table 5

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 radiation and other mutagen treatments for crop improvement	Lund/Svalöf, Sweden and Risø, Denmark 2 June to 10 July 1971	17	SIDA and FAO
Interregional training course on the use of radioisotopes and radiation in animal science and veterinary medicine	Fort Collins, United States 7 June to 16 July 1971	16	Regular programme
Interregional training course on the use of radioisotopes and radiation in entomology	Gainesville, United States 21 June to 13 August 1971	18	Regular programme
Regional training course on radioisotope laboratory techniques (Part II)	Kwabenya, Ghana 5 July to 27 August 1971	27	UNDP(TA) and regular programme
Interregional training course on the use of radioactive tracer techniques in industry and environmental pollution studies	Raleigh, United States 12 July to 6 August 1971	18	Regular programme
Study tour (seminar) on the use of isotopes and radiation in agricultural research	Soviet Union 2 August to 10 September 1971	29	Regular programme
Interregional training course on the maintenance and repair of nuclear electronic equipment	ILO Centre, Turin, Italy 30 August to 3 December 1971	18	UNDP(TA)
Regional training course on non-destructive testing (gamma radiography)	Singapore 4 to 29 October 1971	22	UNDP(TA)
Regional training course on the use of radiation in sterilization and treatment of biomedical products	Buenos Aires and Ezeiza, Argentina 11 October to 19 November 1971	15	UNDP(TA)
Interregional training course on food irradiation technology and techniques	Bombay, India 1 November to 10 December 1971	25	Regular programme
Regional training course on the application of nuclear techniques in plant biochemistry with reference to protein	Bogota 2 November to 3 December 1971	15	UNDP(TA)

Project	Place and dates	Total number of participants	Source of funds
Regional training course on radioactive waste management	Tokyo 4 to 24 November 1971	12	UNDP(TA)
Interregional training course on the preparation and control of radiopharmaceuticals	Prague 8 November to 3 December 1971	22	UNDP(TA)
Advanced regional training course on radiological health and safety measures	Manila 15 November to 3 December 1971	23	UNDP(TA)
Interregional training course on dosimetry for industrial and agricultural radiation processing establishments	Bangkok 15 November to 10 December 1971	19	UNDP(TA)
Regional training course on bid evaluation and implementation of nuclear power projects	Tokyo 29 November to 10 December 1971	22	UNDP(TA)
Training and demonstration programme on advanced atomic energy technology	Asia and the Far East 1 July to 31 December 1971	41	UNDP(TA) and regular programme
Demonstration project on the use of radiation for the preservation of local food products	Asia and the Far East 1 July 1971 to 30 June 1972	356	Regular programme
Research and demonstration project on isotopes in animal parasitology	Kabete, Kenya	12	UNDP(TA)
Study tour (seminar) on radiological protection	Czechoslovak Socialist Republic, Federal Republic of Germany, Sweden and the Soviet Union 2 May to 9 June 1972	30	Regular programme
International training course on the preparation and quality control of radiopharmaceuticals	Los Angeles, United States 5 to 30 June 1972	30	Regular programme
International training course on the use of isotopes and radiation in forestry	Helsinki 5 June to 21 July 1972	15	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

UNDP projects

29. UNDP large-scale projects being carried out by the Agency on 30 June 1972 are summarized in Table 6 below.

Table 6

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	2 643 400	1 493 700
GREECE, Exploration for uranium in Central and Eastern Macedonia and Thrace[a/]	18 May 1971	1.5	250 300	324 800
PAKISTAN, Detailed exploration of uranium and other radioactive occurrences in the Siwalik sandstones in the Dera Ghazi Khan District[a/]	27 September 1971	2.0	700 600	464 400
PHILIPPINES, Nuclear power survey	20 March 1972	0.8	85 000	146 900
INDIA, Demonstration plant for irradiation sterilization of medical products	26 May 1972	3.0	675 400	677 000
ARGENTINA, National centre for non-destructive testing and quality control[b/]	about 1 September 1972	3.0	1 173 700	613 200
BRAZIL, Development of agricultural production through the application of nuclear technology	about 1 October 1972	5.0	2 343 100	919 650
HUNGARY, Irradiation sterilization of medical products	about 1 October 1972	4.0	4 154 000	605 200
CHILE, National nuclear energy centre	about 1 November 1972	3.0	1 735 400	762 100

a/ Implemented in association with the United Nations.

b/ Implemented in association with UNIDO.

FOOD AND AGRICULTURE

Summary

30. The three priorities in the Agency's programme on food and agriculture are to:

(a) Increase yields of important plant crops;

(b) Close the "protein gap"; and

(c) Prevent waste of food.

31. The work has been carried out chiefly through co-ordinated research on selected subjects in which nuclear techniques can be expected to make a contribution. The programmes have been supported by research contracts (listed in Table 7 below), technical assistance, publication of the proceedings of scientific meetings and by manuals of instruction. The agricultural section of the Seibersdorf Laboratory has continued to provide services in entomology, crop nutrition and plant breeding.

Table 7

Research contracts on food and agriculture

Research programme	Countries in which research programme is carried out with Agency support	Starting and ending dates
Rice production	Burma, Ceylon, India, Indonesia, Republic of Korea, Pakistan, Philippines, Thailand, Viet-Nam	1969-
Wheat fertilization	Brazil, Egypt, Greece, Hungary, India[a], Iran, Italy[a], Lebanon, Mexico, Morocco, Pakistan, Peru, Romania, Turkey, Uruguay	1967-
Tree crop fertilization	Ceylon, Colombia, Ghana, Ivory Coast[a], Kenya, Malaysia[a], Philippines, Spain, Uganda	1967-
Physico-chemical relationships of soils and plants	Belgium, Canada[a], Ghana, Hungary, Madagascar, Netherlands[a], Pakistan, United Kingdom[a], United States[a]	1966-
Rice mutation breeding	Brazil, Ceylon, Egypt, Republic of Korea, Malaysia, Thailand, Viet-Nam	1964-
Applications of nuclear techniques for seed protein improvement	Argentina, Australia[a], Chile, Cyprus, Denmark[a], Egypt, Federal Republic of Germany (6[a]), India (2), Jamaica, Japan, Republic of Korea, Nigeria, Pakistan, Philippines, Sweden[a], Thailand, Uganda, United Kingdom[a], United States[a], Yugoslavia	1968-

Research programme	Countries in which research programme is carried out with Agency support	Starting and ending dates
Induced mutations for disease resistance	Argentina, Canada (2[a]/), Denmark[a]/, Federal Republic of Germany[a]/, Hungary, India, Italy[a]/, Republic of Korea, United States (2[a]/), Yugoslavia	1971-
Neutron seed irradiation	Bulgaria, Federal Republic of Germany[a]/, Italy[a]/, Puerto Rico[a]/, United States (2[a]/)	1966-71
Use of isotopes and radiation in control of parasitic and associated diseases in domestic animals	Denmark[a]/, Iraq, Israel[a]/, Italy[a]/, Kenya (2), Uganda, United Kingdom[a]/, United States[a]/, Yugoslavia[a]/	1967-
Fruit fly eradication or control by the sterile-male technique	Federal Republic of Germany[a]/, Mexico, Netherlands (2), Philippines, Portugal, Spain, Switzerland[a]/	1967-
Control of animal insect pests by the sterile-male technique	Belgium[a]/, Federal Republic of Germany[a]/, Kenya, Portugal, United Kingdom[a]/	1967-
Rice insect control and eradication	Republic of Korea, Pakistan (2), Thailand (2)	1968-
Ecology and behaviour of the Heliothis complex as related to the sterile-male technique	Argentina, Colombia, Mexico, United States (4[a]/), Venezuela	1969-
Control of insect populations by the sterile-male technique	Austria[a]/, Romania, United States[a]/, Yugoslavia	1971-
Fate and significance of foreign substances in food	Canada[a]/, Federal Republic of Germany[a]/, Ghana, Israel[a]/, Japan[a]/, Pakistan, United Kingdom (4[a]/)	1971-
Fate and significance of foreign substances in the agricultural environment	Canada[a]/, Finland, Federal Republic of Germany (2[a]/), Hungary[a]/, Netherlands[a]/, Turkey, Uganda, United States[a]/, Yugoslavia	1971-
Shelf-life extension of irradiated fruits and vegetables	Hungary, India, Iraq, Italy[a]/, Philippines, Mexico	1970-
Microbiological aspects of food preservation by irradiation	Argentina, Belgium, Federal Republic of Germany, Republic of Korea, Philippines, Spain (2), United States[a]/	1969-

a/ Cost-free research agreement.

32. There have been several meetings of scientists working in the various programmes, for purposes of co-ordinating their research, reviewing results obtained and planning work for the coming year, such as meetings on:

(a) The use of radiation in the sterile-male technique for control of rice stem borers, at Tokyo in July 1971;

(b) Induced mutations for rice improvement, at Manila in September 1971. This meeting marked the completion of the first five-year period of the programme and reports were given on the successful development of several important mutant lines of rice, some of which have been released to farmers;

(c) The application of induced mutations to confer disease resistance in plants, at Nairobi in December 1971;

(d) The use of isotopes in rice production studies, at Seoul in March 1972; and

(e) The new plant protein improvement programme [9], at Munich, Federal Republic of Germany, in June 1972.

33. Panels were convened in Vienna to consider the use of isotopes in:

(a) The study of fertilizer utilization by leguminous crops;

(b) The use of non-protein nitrogen in cattle nutrition; and

(c) Studies of pesticide residue problems.

Another panel discussed the use of computer models to help in applying the sterile-male technique. A fifth panel meeting at Nairobi in November 1971 considered the use of radiation and isotopes to control parasitic and associated disease in domestic animals.

34. Two study tours, in which scientists from developing countries took part, visited institutes in the Soviet Union to see the use of radiation and isotope techniques in soil science and plant breeding, and in the United States to see laboratories applying the sterile-male technique.

35. The six training courses held on the subject of food and agriculture are summarized in Table 5 above. A study group in Bangkok discussed the use of food irradiation techniques in South and East Asian countries. Symposia were held at Vienna on the use of nuclear techniques in soil/plant relationship studies (including forestry) and at Athens on the use of nuclear techniques in animal sciences.

New trends during 1971/72

36. Recent developments include:

(a) An expansion of the programme for using nuclear techniques in studies of pesticide residues (and other alien chemicals) in food and in the agricultural environment. Interest shown by Member States has permitted the launching of a second co-ordinated research programme in this field as well as research at the Seibersdorf Laboratory;

(b) The first research co-ordination meeting at Munich for the plant protein improvement programme, which is chiefly supported by the Federal Republic of Germany. Research is being done under contract in many

[9] See also para. 36(b) below.

institutes in developing countries while selected laboratories in the Federal Republic of Germany, as well as the Agency's Laboratory, are providing special services and carrying out advanced research. The main object is to use induced mutations not only to improve protein content and quality but also to breed for resistance to disease. In the related crop nutrition programme, there is also more emphasis on research on protein-rich legumes and studies of protein synthesis and accumulation in grain; and

(c) The International Food Irradiation Project launched in January 1971 which has now been joined by Finland, bringing the number of participating countries to 21 and is extending its activities to cover wholesomeness testing in fish, as well as the earlier and continuing work on potatoes, wheat and wheat products.

Field activities

37. The successful establishment of a national centre for nuclear research in agriculture at Zemun in Yugoslavia has opened the way for similar institutes in other developing countries. With the use of UNDP funds, projects are under way in Brazil, Chile and India, while others are being considered by Lebanon and the Philippines.

38. The following table summarizes the field projects being carried out under the food and agriculture programme as a whole.

Table 8

Food and agriculture: field projects

Type of project	Number
Large-scale UNDP projects	3
UNDP	18
IAEA regular programme	32
IAEA research contracts and agreements	
(a) Agriculture	187
(b) Food preservation	13
Special projects (Government-financed)	5
Fellowships	over 40

39. The results of one of the UNDP projects in India have confimed that the use of radiation-attenuated vaccines against lung worm is most effective. Sheep that were inoculated in field trials have gained significantly in weight. The Indian Government is planning to use this technique on a large scale in the more temperate parts of the country.

40. Three new varieties of rice have been released to farmers as a result of work carried out under Agency research contracts (two in Dacca and one in the Philippines) while other improved mutants are being tested before being released in Ceylon, India, the Republic of Korea and the Philippines.

LIFE SCIENCES

Radiation biology

41. The current programme of support for research in radiation biology is summarized in Table 9 below.

Table 9

Research contracts on radiation biology

Research programme	Countries in which research is conducted with Agency support	Starting and ending dates
Radiation sterilization of biomedical products and biological tissues	Czechoslovak Socialist Republic, Denmark (1+1[a]), Greece, Hungary[a], Poland, United Kingdom[a]	1967-73
Use of radiation and radioisotopes for the improvement of industrial microorganisms	Austria (1+1[a]), Czechoslovak Socialist Republic, France (2[a]), Greece, India, Nigeria, Pakistan, Singapore, United Kingdom	1970-
Studies of the effects on living systems of radiation alone and in combination with other environmental factors	Austria (1+1[a]), India[a], Iran, United Kingdom	1969-
Radiation biology of neutrons and heavy particles	Argentina	1972-
Use of radiation in the preparation of vaccines against parasites, pathogens and toxins	Belgium, Thailand, Yugoslavia[a]	1969-
Basic problems in radiation biology	Chile, Czechoslovak Socialist Republic, Ecuador, Greece, Hungary, Nigeria, Poland, Romania, Sweden, Turkey (2), Uruguay	1970-

a/ Cost-free research agreement.

42. Work carried out under the first research programme listed has resulted in the development of biological monitoring systems which consist of suitable strains of bacteria to be used in testing the efficiency of radiosterilization plants. Recommended standards for practice of radiosterilization of medical products have been formulated.

43. Two mutants have been obtained as a result of work carried out under the second programme. One mutant of the yeast Saccharomyces derived by radiation treatment has a higher yield of the amino acid, methionine. Another mutant in the industrially useful fungus Rhizopus shows a delay in conidial (airborne spore) formation. This makes the industrial handling of the organism much easier.

44. The third and fourth programmes are currently in the early stages of development; the latter is concerned especially with the effects which heavy metals, chemicals, pharmaceuticals, etc. may have on the radiation sensitivity of cells and organisms.

45. Under the fifth programme means have been found to sterilize and detoxify Russell's viper venom and cobra venom by the use of radiation. The non-toxic venoms also retain high ability to induce antibody production in rabbits, and thus should be useful as vaccines and in the production of antisera.

46. Some of the main meetings held on these subjects during the reporting period were:

(a) An inter-agency meeting on co-ordination of microbiology programme activities (Vienna, September 1971);

(b) A regional training course for South America on the use of radiation for sterilization and treatment of biomedical products (Buenos Aires, October 1971);

(c) A panel meeting on radiobiological applications of neutron irradiation (Vienna, December 1971);

(d) A joint Agency and WHO working group meeting for the establishment of international standards for the practice of radiation sterilization of biomedical products (Copenhagen, June 1972).

Medical applications

47. The general direction of the Agency's work on radioisotope applications in medicine remains the same as in previous years; research support programmes on these applications are summarized in Table 10 below. Except for the first one (anaemia) which has been completed, all programmes were started in 1969 and are being continued.

Table 10

Research contracts on radioisotope applications in medicine

Research programme	Countries in which research is conducted with Agency support	Starting dates
Anaemia	Cuba, South Africa	1958 being phased out
Whole-body counting techniques and their applications, especially in relation to problems of nutrition and public health	Romania	1969-
Radioisotope techniques and their applications in studies of iron metabolism	Chile, India, Jamaica, Lebanon, Mexico, South Africa, Sudan, Sweden[a], Thailand, Turkey, United States[b]	1969-
Radioactive techniques and their applications in studies of trace elements and mineral metabolism in man	Bulgaria, Federal Republic of Germany[a], Greece, Italy, United Kingdom[a]	1969-
In vitro assay techniques, such as saturation analysis and radioimmunoassay techniques, and their applications	Argentina (2), Bulgaria, Chile (2), Ecuador (2), Greece (2), Republic of Korea, Nigeria (3), Peru, Uganda, Zambia	1969-

Research programme	Countries in which research is conducted with Agency support	Starting dates
Radioisotope techniques and their applications in immunological studies of communicable diseases	India, Iran, Nigeria, Peru, Switzerland, United States	1969-
Radiopharmaceuticals and techniques for scintigraphy and their applications	Argentina, Colombia, Czechoslovak Socialist Republic, France[a], Federal Republic of Germany (3[a]), Greece, India (2), Japan[a], Mexico, Poland, Romania, Sweden[a], United Kingdom (2[a]), United States (3[a]), Uruguay (2), Viet-Nam	1969-
Radioisotope techniques in cardiovascular studies	Argentina (2), Hungary, Spain, Sudan	1969-

a/ Cost-free research agreement.

b/ Technical contract.

48. Meetings held on the application of radioisotopes in medicine include:

(a) A panel on applications of radioactive tracer techniques in microbial immunology (Vienna, October 1971);

(b) A joint Agency/WHO expert committee on the medical uses of ionizing radiation and radioisotopes (Geneva, October/November 1971), which reviewed needs and priorities in the various branches of radiation medicine;

(c) A joint Agency/WHO seminar on the training of radiographers and other technical staff in the medical uses of radiation and radioisotopes (Tehran, December 1971), which reviewed the requirements for the training of technical staff for work in radiation medicine;

(d) A joint Agency/WHO seminar on training and education in medical physics (Kiel, Federal Republic of Germany, April 1972), which reviewed the requirements for the training of medical physicists; and

(e) A panel on in vivo activation analysis (Vienna, April 1972).

Dosimetry

49. The Agency's programme on dosimetry consists chiefly of providing services to Member States. The postal distribution of calibrated dosimeters, begun in 1968, has steadily expanded (105 users in 1969; 180 in 1971). The encapsulated dosimeters prepared in the Agency's Laboratory are distributed by WHO to hospitals and other institutes and are used chiefly for calibrating cobalt or caesium sources used in cancer treatment. Much interest is also being shown in the use of computers in radiotherapy, and the Agency may be able to provide another service in this regard. It is expected that all such services will become self-supporting at a later stage.

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

(a) A study tour of radiation calibration facilities in the Czechoslovak Socialist Republic, France, the Federal Republic of Germany, the Soviet Union and the United Kingdom; [10]

(b) An interregional training course on dosimetry for industrial radiation processing establishments (Bangkok, November/December 1971); [10]

(c) A panel on national and international radiation dose intercomparisons (Vienna, December 1971); and

(d) A symposium on dosimetry techniques applied to agriculture, industry, biology and medicine (Vienna, April 1972).

51. The co-ordinated research projects and research contracts concerned with dosimetry are listed in the following table:

Table 11

Research contracts on dosimetry

Research programme	Countries in which research is conducted with Agency support	Starting and ending dates
Co-ordinated research programme on the biophysical aspects of radiation quality	Netherlands[a/], United Kingdom (3[a/]), Yugoslavia[a/]	1966-73
Co-ordinated research programme on the computer application in clinical dosimetry	Austria[a/], United States (2[a/])	1971-72
Comparative study of different thermoluminescent dosimetry materials	Poland	1971-72
Deoxycytidine levels in urine and plasma as an index of ionizing radiation dose	United Kingdom	1970-73
Direct internal radiation dosimetry of radiopharmaceuticals by improved needle-type fluoroglass dosimeters	Japan	1969-72
Dosimetry of ionizing radiation by chemical methods	Belgium	1969-72
Dicarboxylic acids as chemical dosimeters	Yugoslavia	1971-74

a/ Cost-free research agreement.

[10] See also Table 5 above.

PHYSICAL SCIENCES

Physics

52. The main objectives of the Agency's programme on physics are to support the development of nuclear energy sources, both fission and fusion, and the introduction of nuclear power to developing countries, chiefly by means of arranging exchange of information on fission, neutron and selected solid-state physics.

Table 12

Research contracts on physics

Research programme	Countries in which research is conducted with Agency support	Starting and ending dates
Neutron and nuclear physics	Brazil, Hungary, Yugoslavia	1968-
Fission physics	Israel, Italy, Poland	1971-
Solid-state physics and radiation damage	Bulgaria, Greece, South Africa, Soviet Union, United Kingdom	1969-

53. The following were some of the main activities during the period covered by this report:

(a) Recently developed nuclear techniques (Mössbauer spectroscopy, perturbed angular correlations, nuclear orientations) and some well-established methods (electron spin resonance, nuclear magnetic resonance) were compared at a consultants' meeting held in Vienna in November 1971;

(b) A meeting of consultants on fusion power and the environment (Vienna, December 1971) was convened to advise on the evaluation of environmental effects of fusion reactors;

(c) The discussions at the fifth symposium on neutron inelastic scattering, held at Grenoble, France, in March 1972, demonstrated the value of neutron methods for investigating solids, liquids and magnetic properties, and their applications and potential for studies of molecular crystals, phase transitions and chemical systems; and

(d) The Agency co-sponsored the third international conference on thermionic electrical power generation, at Jülich in the Federal Republic of Germany, in June 1972. Considerable progress has been made in thermionic energy conversion since the second conference in 1968, and in particular thermionic reactor systems for space and underwater applications were discussed.

Nuclear data

54. The exchange of experimental neutron data through the computer-based system EXFOR is proceeding satisfactorily and a large amount of data is being supplied to 41 Member States. The scope of the exchange is being extended to include data needed in reactor shielding calculation.

55. Assistance has been given to developing countries in the purchase of accelerator targets and samples needed for such measurements. A panel in Vienna in September 1971 made a world-wide survey of the needs of evaluated neutron data, which will shortly be published.

56. The international working group on nuclear structure and reaction data met for the first time in Vienna in March 1972. A number of measures were taken to co-ordinate compilation and exchange of non-neutron nuclear data needed.

Chemistry

57. Projects under the Agency's programme on chemistry included:

(a) A panel meeting on the preparation of compounds labelled with accelerator-produced radionuclides (Amsterdam, October 1971). This section of nuclear chemistry is growing rapidly. ^{11}C labelled compounds are now produced on a significant scale for studies in medicine and biology and four step syntheses of organic molecules containing ^{11}C are possible. $^{13}NH_3$ shows promise as a means of diagnosing infarcts as it concentrates in the myocardium;

(b) An interregional training course on the preparation and control of radiopharmaceuticals (Prague, November/December 1971); [10]

(c) A symposium on analytical methods in the nuclear fuel cycle (Vienna, November/December 1971). In general, satisfactory methods exist for the analysis of nuclear fuels. While this augurs well for international trade in such fuels, development of such methods is severely handicapped by the lack of suitable standard reference materials which might usefully be prepared under the auspices of the Agency; and

(d) Publication of a comprehensive manual entitled "Radioisotope Production and Quality Control".

58. Work on the co-ordinated research programme on the quality control of radiopharmaceuticals has continued [11] and a second co-ordinated research programme on neutron detection and analysis has been started. Additional work on the properties of Chitosan (a naturally occurring ion-exchange resin) and on electron spectroscopy for chemical analysis was sponsored. Further efforts were made to launch regional co-operative projects.

Isotope hydrology

59. The Agency served as a sub-contractor to executing agencies in large-scale projects on water resources development in Algeria (Hodna), Algeria-Tunisia (Northern Sahara), Spain (Canary Islands), Chad, Jamaica, Senegal and Surinam.

60. Technical assistance programmes in isotope hydrology were carried out in Brazil, Colombia, Ecuador, Greece, India, Mexico, Poland, Turkey, Uruguay and Yugoslavia.

61. The following table summarizes the Agency's support for research in isotope hydrology:

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[11] See document GC(XV)/455, para. 58.

Table 13

Research contracts on isotope hydrology

Research programme	Countries in which research is conducted with Agency support	Starting and ending dates
Isotope techniques in hydrology of the Aconcagua river basin	Chile	1969-73
Deuterium/tritium profile through the Batnajoekull ice cap	Iceland	1971-74
Variability in isotopic and chemical composition in rivers	Nigeria	1971-74
Isotopic study of groundwater in the Nidge-Misli plain	Turkey	1970-72
Isotopes in aquifers of the Northern Sahara	Algeria	1971-73
Measurement of deuterium and oxygen-18 in natural waters	Denmark	1961-
Connection of subsoil water and groundwater using isotopes in the Nile delta	Egypt	1969-72
Environmental isotope survey	Cyprus	1971-73
Carbon-14 and other environmental isotope study in extensive aquifer systems	Senegal	1970-72
Determination of oxygen-18/ oxygen-16 ratio in precipitation	Hungary	1969-72
Isotopic content of precipitation	Chile	1970-73
Isotopic methods in tropical soil hydrology	Indonesia	1970-72
Environmental isotopes in experimental basins of the Hupselse Beek	Netherlands	1971-74
Effectiveness and application of environmental tritium as a groundwater tracer in a semi-arid region	South Africa	1968-72

Industry

62. The use of ionizing radiation has become widely recognized as an effective tool in the sterilization of single-use, disposable medical supplies. In 1972 the Agency began a three-year project in India relating to the radiosterilization of medical products[12], setting up, with UNDP assistance, a demonstration plant using 300 000 curies of cobalt-60 as source.

63. Non-destructive testing techniques, many of which are based on nuclear methods, are indispensable for quality control and for safety in industry. In 1971 the Agency began to implement, in association with UNIDO, a UNDP project for setting up a national centre for non-destructive testing and quality control in Argentina. [12] During the three-year project radiography and other non-destructive testing techniques will be applied to heavy machine, construction and transport industries. A training course on non-destructive testing was conducted in Singapore in October 1971 in order to introduce the techniques to participants from Asia and the Far East.

64. Tracer techniques have been used successfully to improve plant efficiencies in the chemical and metallurgical industries. In July 1971 the Agency conducted an international training course on the use of radioactive tracer techniques in industry and environmental pollution studies, at Raleigh, North Carolina, United States[10].

65. A co-ordinated research programme on the use of neutron activation analysis in geochemical and geobotanical prospecting for mineral resources such as gold and copper has been continued. Research work on wood-plastics was done in Ecuador, Finland, Iraq and Romania.

Laboratories

Seibersdorf Laboratory

66. In the period under review, a double tracer technique has been developed for an improved study of root activity patterns by tree crops. The plant breeding programme based on mutations induced by radiation and aimed at the improvement of protein quality in wheat, legumes and barley has begun. Pilot field trials of the sterile insect release method have been carried out with the Mediterranean fruit fly in Israel and Tunisia. Work on mass rearing and on radiation sterilization of the tsetse and olive flies and of the almond (or cocoa) moth, continue to make progress.

67. About 200 chemical analyses for uranium and plutonium content have been made of samples obtained by inspectors in connection with the Agency's safeguards activities. In addition, the isotopic content of uranium has been determined by gamma spectroscopy.

68. Analytical studies of the chemical control of radiopharmaceuticals in the molybdenum-99/technetium-99m and tin-113/indium-113m systems have been made. Neutron activation analysis has shown a correlation between the gold content of plants and that of soil in an investigation of geobotanical prospecting.

69. The Laboratory has provided training to fellows from India, Indonesia, Iran, Iraq, Israel, Kenya and Tunisia.

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[12] See Table 6 above.

International Laboratory of Marine Radioactivity in Monaco

70. The Monaco Laboratory has continued the programme of intercalibration of radiochemical methods of analysis of marine environmental samples, with the financial assistance of UNESCO. The first intercalibration test on sea-water samples, distributed to 44 laboratories in 25 countries, has been completed. Few of the participating laboratories are able to assay several radionuclides at monitoring levels. The intercalibration should be continued and extended to cover shellfish, sediments and other "media" as well as other radionuclides. The results were discussed at a consultants' meeting.

71. Studies were continued on chemical, biological and physical aspects of the behaviour of various radionuclides in the marine environment. The Laboratory has also served as a centre for the co-ordinated Agency research programme on marine radioactivity studies, in which several national laboratories are participating.

International Centre for Theoretical Physics at Trieste

72. The past year was the most active one of the Centre. The highlights were two extended courses and two research workshops, one in nuclear physics and one in solid-state physics. In addition, research work was carried out throughout the year in particle physics and topical meetings were arranged on quantum gravity, photon physics and aspects of astrophysics and physics of the oceans. Some 760 physicists from 64 countries took part in these activities. One hundred and fifty research papers in high-energy, solid-state, nuclear physics and gravity theory were issued by the Centre in 1971.

73. The activities of the Centre in nuclear physics and solid-state physics were a continuation of past work; a new activity was the Seminar on Computing as a Language of Physics, held from 2 to 20 August. This was the largest course the Centre has organized, and aroused unusual interest - nearly 500 applications were received. Two hundred and thirty nine scientists from 56 Member States and four international organizations took part besides the scientists present at the Centre at that time; 133 participants came from 40 developing countries, but because of shortage of funds financial support could be given to only 51.

74. During 1971 the Centre received its first financial support from two UNDP large-scale projects for which UNESCO is the executing agency. These projects, entitled "Solid-State Physics, Training and Research Centre" and "Training and Research Centre in Applicable Mathematics and Computer Science", support training and research programmes in mathematics and computer science, and in solid-state physics, for participants from developing nations.

NUCLEAR TECHNOLOGY

General

75. There was a resurgence in orders for nuclear power plants in 1971. The 52 power reactors ordered, with a total capacity of 46 572 MW, represented about half of all orders for electrical power station capacity. Previous forecasts that the share of nuclear power in the total electric production would rise from 2% in 1970 to 14% by 1980 and, possibly, to 50% by the turn of the century still seem valid. These forecasts are summarized in Table 14 below.

Table 14

Forecast of installed capacity
(in thousands of MW)

	1970	1975	1980	1990	2000
Electrical	1 100	1 600	2 300	4 300	7 000
Nuclear[a/]	20	115	310	1 300	3 500

a/ See also Agency publication "Power and Research Reactors in Member States, 1971 Edition" (STI/PUB/194/4).

76. Reports given at the Fourth International Conference on the Peaceful Uses of Atomic Energy showed that industry is settling upon the production of proven reactor-type designs and tending to standardize components and to construct series of almost identical plants. Nuclear manufacturing industry is also becoming more concentrated and efficient. The general trend is to expand production of thermal reactors of proven types and at the same time to make a major effort to develop fast reactors.

77. The Conference also showed that developing countries are coming to regard nuclear power as essential for their future energy plans; not a single country which presented reports at the Conference expected to rely solely on conventional sources to meet its long-term electricity requirements. By 1980, nuclear power will only represent 7% of the total capacity of developing countries compared to 16% of that of industrial countries, but the growth of nuclear power in the former group is likely to accelerate after 1980. Wide differences in levels of development and in availability of energy supplies make the problem of timing of nuclear power programmes and of selecting sizes and types of stations particularly complex for developing countries.

Power reactors

78. The Agency has launched a survey of the market for nuclear power in selected developing countries during the next 5-15 years. The survey is expected to provide clearer information about the number and size of nuclear units of particular interest to such countries and the timing of their installation. Initial enquiries have shown that 15 countries wish to participate in the survey, while financial support and/or specialist services have been offered by several advanced countries. The survey will include power demand forecasting, system stability analysis and system analysis studies. The methodology and the plan of work was reviewed and approved at a meeting of sponsors held in Vienna in June 1972. The results of the survey will be available towards the end of 1973, and should help nuclear industry to plan the development and production of plants, and financial institutions to anticipate the needs, of the countries concerned.

79. Introducing nuclear power in a developing country requires careful planning for five to ten years before construction actually starts. In response to the wishes of a number of Member States, the Agency is preparing a booklet on the main steps involved in planning for a first nuclear power station and on the supporting and co-ordinating work that must be done. The Agency also held a regional training course in Tokyo in November and December 1971 on the evaluation of bids for, and the implementation of, nuclear power projects. It is also serving as the executing agency for a UNDP financed feasibility study for a nuclear power plant in the Philippines which might be commissioned in 1978 or 1979. Furthermore, the Agency is publishing an improved version of its annual report on operating experience with nuclear power stations in Member States.

Nuclear desalting

80. Many metropolitan areas in developing and developed countries alike are considering nuclear desalting to meet their water requirements in the 1980s. The Agency has assisted the Peruvian Atomic Energy Control Board in evaluating the potential for nuclear power and desalination for Lima. It has also provided further assistance to the Pakistan Atomic Energy Commission in determining the feasibility of nuclear desalination in Karachi.

Nuclear materials

81. The Agency and NEA have continued jointly to review uranium resources and production and world demand. A joint survey was presented at the Fourth Geneva Conference and a review will be made by an Agency/NEA working party during 1972. The Agency also held a consultants' meeting on specifications to be used for uranium prospecting and evaluation instruments (November 1971) and a panel on uranium exploration methods (April 1972). Assistance was provided to 12 developing countries in exploring for uranium (Bolivia, Cameroon, Chile, Egypt, Greece[12], Iraq, Libyan Arab Republic, Mexico, Nigeria, Pakistan[12], Peru and Turkey).

Supply of nuclear materials

82. Requests for nuclear materials approved by the Board, or being implemented under the authority delegated to the Director General by the Board in September 1968, are listed in the following table.

Table 15

Supply of nuclear materials

Receiving State/ organization	Purpose	Quantity and type of fissile material	Approximate enrichment (when applicable)
IAEA	Samples for wet chemistry analysis	53 g ^{235}U[a]	1.85-3.5%
IAEA	Samples to develop procedures for non-destructive measurements	UO_2 powder contained in 5 samples[a]	1.5-6%
IAEA	Calibration of mass spectrometry	4.5 g ^{235}U contained in 9 uranium isotopic standards[a]	20, 49, 75%

Receiving State/ organization	Purpose	Quantity and type of fissile material	Approximate enrichment (when applicable)
India	Research	48 g uranium in 2 depleted uranium foils with 400 ppm ^{235}U[a/]	
India	Research	100 μCi ^{233}U[a/]	
Indonesia	Fuel for a research reactor	2400 g ^{235}U	20%
Mexico	Research	Plutonium sulphate (1.5 g plutonium), U_3O_8 (5 g uranium) contained in 36 samples[a/]	1-75%
Poland	Standard reference material for use in mass spectrography	Plutonium sulphate (0.75 g plutonium), U_3O_8 (5 g uranium) contained in 8 samples[a/]	
Romania	Research	180 g ^{235}U contained in uranium metal plate, UO_2 powder, 4 fission foils[a/]	90%
Romania	Research under Agency research contract No. 1121/RB	Uranium hexafluoride (UF_6) contained in two sets of 6 samples of 20 g each[a/]	0.5-90%
Uruguay	Fuel for a research reactor	1660 g ^{235}U[b/]	93%
Venezuela	Fuel for a research reactor	5032 g ^{235}U[b/]	20%

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

b/ This request has not yet been approved by the Board.

83. The allocation of special fissionable material to the value of $50 000 granted by the United States for 1971 is shown in the table below.

Table 16

Allocation of special fissionable material granted by the United States for 1971

Receiving State	Value in dollars
Greece	15 425
Pakistan	2 000
Zaire, Republic of	32 575
	50 000

Reactor physics and research reactors

84. Two regional study group meetings on research reactor utilization, held in Bandung, Indonesia, in August 1971, and in Santiago in December 1971, gave special attention to engineering research, activation analysis, isotope production and neutron radiography. The Bandung meeting resulted in the establishment of two co-ordinated research programmes on activation analysis and neutron scattering, in which India, Indonesia, the Republic of Korea, the Philippines and Thailand are participating. The Agency is also studying the possibility of a co-operative research programme in activation analysis in the Latin American region.

85. A meeting of the working group on nuclear power plant control and instrumentation was held in April 1972 in Rome, in conjunction with a specialist meeting on analysis of measurements to diagnose potential failures. Two earlier meetings held respectively in Brussels, in October 1971, and Winfrith in the United Kingdom, in January 1972, dealt with experience acquired in the use of computers in operating plants and with problems relating to the installation and commissioning of nuclear power plants.

86. In January 1972 the Agency held a seminar on developments in numerical reactor calculations, dealing with new techniques appropriate to computers of the latest generation, and with techniques applicable to the use of smaller machines which are of interest to smaller reactor centres.

87. An international meeting of specialists in closed-cycle MHD electrical power generation was held in September 1971 in Eindhoven in the Netherlands. The eighth meeting of the joint Agency/NEA international liaison group on MHD, held in Moscow in December 1971, approved a comprehensive report on this subject.

88. In recognition of developments which have taken place in recent years in reactor burn-up physics, the Agency convened a panel of experts on this subject in July 1971.

Nuclear explosions for peaceful purposes

89. On 21 June the Board adopted guidelines for the observation by the Agency of nuclear explosions for peaceful purposes. This procedure is provided to ensure that obligations undertaken under NPT or under analogous provisions in other international agreements are not violated. It has been communicated to all interested States.

90. A review of the technology relating to nuclear explosions for peaceful purposes was undertaken at the Fourth International Conference on the Peaceful Uses of Atomic Energy at Geneva and the Agency is planning to hold a further panel in 1972 on the subject.

ENVIRONMENTAL OPERATIONS

General

91. As in the past the main objective of the Agency's programme relating to environmental operations has been to secure the protection of man and his environment from harmful effects of nuclear radiation and radioactive and non-radioactive releases from nuclear facilities. During the period covered by this report particular attention has been given to:

(a) Preventing environmental pollution;

(b) Assessing radiological hazards and reactor safety;

(c) Organizing environmental monitoring programmes;

(d) Up-dating the Agency's safety standards and recommendations;

(e) Assisting Member States to apply the Agency's safety standards in their nuclear activities; and

(f) Providing radiological services, including monitoring for external and internal radiation, for the staff of the Agency's laboratories and in connection with safeguards inspections.

92. Among the 16 publications issued were five technical reports, three safety reports, the proceedings of two symposia and two consultants' reports. Six panels were held on various subjects as well as two symposia and three meetings of consultants.

93. The Agency has strengthened its collaboration with WHO in radiological and environmental protection and a number of publications were issued jointly. Collaboration with ILO, FAO, UNESCO, WMO and NEA has been continued.

Research support

94. Table 17 below shows the distribution of research contracts and agreements relating to radiation protection, waste management and environmental pollution.

Table 17

Research contracts on radiation protection and waste management

Research programme	Countries in which research is conducted with Agency support	Starting and ending dates
General matters of radiation protection		
Chromosome aberrations in the peripheral blood lymphocytes of people living in areas of higher atmospheric concentration of natural radon-222	Austria	1969-72
Correlation of internal radiation doses from incorporated isotopes and chromosome aberrations	Bulgaria	1970-72

Research programme	Countries in which research is conducted with Agency support	Starting and ending dates
Application of chemical detectors resonantly responsive to photons in the range of 10-35 keV	Belgium	1971-72
Further development of semi-conductography for low energy beta nuclides and its applications for standard radioactive sources in chemistry and biology	Czechoslovak Socialist Republic	1971-72
Biological indicators of radiation injury	Czechoslovak Socialist Republic	1970-72
Studies of the retention and elimination of radioactive iodine from the human body	Greece	1970-72
Determination of neutron spectra behind different shields	Hungary	1971-72
Comparison and development of advanced dosimetric techniques to be used under extreme climatic conditions	India	1971-72
Internal radiation dose to the population resulting from radio-nuclides in the environment	Israel	1971-73
Study of sorptive and exchange reactions of tuff and soil samples at the PARC site	Philippines	1966-71
Studies on factors affecting accuracy of individual dose measurements by means of radioluminescent and thermoluminescent dosimetric systems	Romania	1970-72
Radon and SiO_2 toxicity on rats' lungs	Yugoslavia	1968-72
Accident dosimetry		
Method of selective measurement of thermal neutrons and gamma-radiation exposures in a mixed radiation field for normal and accident conditions by means of thermoluminescent dosimeters of multiple use	Bulgaria	1970-73
Estimation of dose from neutrons below 500 keV in a criticality accident	Canada[a/]	1970-72

Research programme	Countries in which research is conducted with Agency support	Starting and ending dates
Thermoluminescent dosimetry	Czechoslovak Socialist Republic[a/]	1970-72
Nuclear accident dosimetry	France[a/], Federal Republic of Germany[a/], Hungary[a/], India[a/], Japan[a/]	1970-72
Radiation detectors for use in nuclear criticality accident dosimetry	Poland	1970-72
Nuclear accident dosimetry	United Kingdom[a/]	1970-72
International standardization centre for nuclear accident dosimetry systems	United States[a/]	1970-72
Study of the characteristics of emergency radiation dosimeters	Soviet Union[a/]	1970-73
Nuclear accident dosimetry	Yugoslavia[a/]	1970-72
Measurement techniques		
Use of solid-state detectors for detecting alpha-particle tracks and their application of such detectors to the measurement of airborne contamination	France	1968-72
Methods of depth distribution measurement of Pu in the human body	Egypt	1969-72
Studies in thermoluminescent dosimetry	India	1968-72
Uptake of radioactive materials through food chains	Pakistan	1970-71
Transport packagings		
Demonstration of the effectiveness of the closures of packages containing large radioactive sources	Sweden[a/]	1969-
Low- and medium-level radioactive waste management		
Study of sorptive and exchange reactions of tuff and soil samples at the PARC site	Philippines	1966-71
Bitumen and natural sorbents for use in the processing and disposal of radioactive wastes	Bulgaria	1968-72
Study of conditions for the burial of radioactive asphalts	Soviet Union	1969-71
Treatment and disposal of low-level sludges by solar evaporation	Republic of Korea	1971-72

a/ Cost-free research agreement.

Radiological safety

95. During the period covered by this report, the following meetings related to radiological safety have been organized:

(a) A symposium on rapid methods for measuring radioactivity in the environment (Munich, Federal Republic of Germany, July 1971), which discussed technical, economic and operational aspects of such methods;

(b) A panel (October 1971) which completed the review of the Agency's regulations for the safe transport of radioactive materials;

(c) A consultants' meeting (Geneva, October 1971) which reviewed the draft text of a manual on radiation protection in hospitals and general medicine, which is being prepared jointly by the Agency, WHO and ILO;

(d) An Agency/WHO symposium on the assessment of radioactive organ and body-burdens (Stockholm, November 1971) which included discussion of the determination of body-burdens by whole-body counting and by excretion analysis, and of the determination of radiation dose in normal occupational exposure and as a result of an accidental release of contaminants;

(e) A panel (November 1971) which prepared a manual of advisory material on the implementation of the transport regulations;

(f) A panel (November 1971) which prepared a manual of guidance on the safe handling of plutonium in quantities below the limits at which criticality hazards need be considered; and

(g) A joint Agency/NEA symposium on the maritime carriage of nuclear materials (Stockholm, June 1972) which reviewed the technical, legal and insurance aspects of the carriage of nuclear materials by sea.

96. An advanced regional training course on radiological health and safety measures (Manila, November/December 1971) provided training for specialists in South East Asia and the Far East who are responsible for radiological safety programmes for the protection of persons and the environment. In the course special attention was given to the assessment of radiological hazards in various types of operations and to environmental surveillance programmes.

97. A study tour on radiological protection was organized in the Czechoslovak Socialist Republic, the Federal Republic of Germany, Sweden and the Soviet Union in May and June 1972. [10]

98. Arrangements have been made to collect and distribute on a world-wide scale information on accidents involving consignments of radioactive material in transport. This information will be helpful in evaluating the effectiveness of the packaging prescriptions. Arrangements have also been made with WHO and NEA to compile and distribute information on products containing radioisotopes that are to be introduced into international trade.

Waste management

99. In March 1972 the Board decided that one of the Agency's most important and urgent tasks, in which it should take the leading role, in close collaboration with the other international organizations concerned, was the elaboration of recommended standards of safety concerning the dispersion into the environment of radioactive waste resulting from the peaceful use of nuclear energy. The Director General was invited to include in the Agency's programme proposals aimed at obtaining the data necessary for the support of research in

Member States, and by international organizations, for the elaboration of such standards of safety. Corresponding amendments to the Agency's programme for 1973-78 have now been introduced.

100. Following further recommendation the Director General informed the United Nations Conference on the Human Environment (Stockholm, June 1972) of the Board's decision and of the Agency's pre-eminent interest in the matter of the release of radioactive waste. The Conference recommended inter alia that Governments, without reducing in any way their attention to non-radioactive pollutants, should explore with the Agency and WHO the feasibility of developing a registry of releases to the biosphere of significant quantities of radioactive materials; and should support and expand, under the Agency and appropriate international organizations, international co-operation on radioactive waste problems.

101. Work done in preparation for the Conference included a book on "Environmental aspects of nuclear power production", prepared jointly by the Agency and WHO, and designed to give a technical but non-specialist audience a concise and scientifically accurate view of the subject.

102. A panel was convened (Vienna, November 1971) to discuss the effects of ionizing radiation on aquatic organisms and ecosystems. An advanced regional training course on radioactive waste management (Tokyo, November 1971) provided training for specialists in South East Asia who are responsible for management of radioactive wastes and for environmental protection.

103. The Agency is taking steps to improve its research contracts programme on the behaviour of radionuclides in the environment and convened a group of experts in April 1972 to advise it on this matter.

Nuclear safety

104. To help Member States select sites for nuclear plants or make the safety reviews needed for obtaining construction and operating approval, the Agency sent safety missions to the Republic of Korea (October 1971 and May 1972), the Philippines (March 1972), Thailand (March 1972) and Singapore (March 1972). A safety review of a nuclear institute was also made in Spain in January 1972.

INFORMATION AND TECHNICAL SERVICES

The International Nuclear Information System (INIS)

105. By June 1972, 41 countries and 11 international organizations were participating in INIS. During the second year of INIS operation (July 1971 to June 1972), data on 12 070 items of nuclear science information were distributed to participants, an increase of almost 40% over the previous year.

106. The Advisory Committee for INIS, whose appointment was approved by the Board in February 1971, met in November 1971. It recommended inter alia that the system should be expanded to cover all categories of nuclear information (full subject scope) and that the thesaurus for use in indexing, which the Secretariat had developed with the help of consultants, should enter into use at the same time as full subject scope was introduced.

107. In March 1972 the Board decided that INIS should begin as soon as possible in 1972 to operate with the full subject scope. The Board also requested the Director General to give effect to the Advisory Committee's other recommendations with a view to increasing the utility of INIS to the membership of the Agency as a whole, and to provide the Board during 1975 with a comprehensive report on the operation of INIS in the years 1972-74, to enable it to review the operation of the system.

108. A regional INIS training seminar for Latin America was held in Buenos Aires from 22 November to 10 December 1971; a seminar on indexing was held in Vienna in June 1972. As a further aid to developing countries, on-the-job training in INIS work was given at the Agency's Headquarters to five trainees from Egypt, India, the Philippines and Turkey.

109. Close co-operation is being maintained with other international organizations, particularly with UNESCO, in regard to the development of UNISIST, a world science information system and to the creation of an INIS regional centre in India with UNDP assistance.

Computer services

110. The total use of the Agency's computer had increased from 400 hours per month in June 1971 to 450 hours per month by June 1972. During the same period, the share of the Agency's administrative services in the use of the computer declined from 31% to about 25%; that of UNIDO increased from 20% to over 25%; and that of INIS from 16% to 23%.

111. Since the present computer is fully loaded and additional capacity and capabilities are needed, plans have been made to install an IBM 370/145 computer in July 1972. This computer will have greater storage capacity (206 K) than the present IBM 360/30 (64 K), and will increase considerably the computer capacity available to the Agency and UNIDO.

112. Since March 1968, by arrangement with NEA, the Agency has made available programmes from the NEA computer programme library at Ispra, Italy, to Member States that are not members of NEA. During 1971, 69 programmes and reports were sent to such Member States, and 13 programmes were donated by them to the library.

Scientific meetings

113. Comparative information for recent years on participation in Agency conferences, symposia and seminars is given in the following table.

Table 18

Conferences, symposia and seminars

	1969-70	1970-71	1971-72
Meetings	13	16	8
Participants	2225	2686	941
Countries taking part	67	65	53
Papers presented	710	784	397

Fourth International Conference on the Peaceful Uses of Atomic Energy

114. The Fourth International Conference on the Peaceful Uses of Atomic Energy held in Geneva from 6 to 16 September 1971 attracted some 4000 participants and bore witness to the growing commercialization of nuclear energy, particularly for power production. A wealth of information was given on the experience gained in the operation of various types of nuclear power stations. A highlight of the Conference was the study of effects of nuclear power on the environment, including the problem of public acceptance of nuclear power plants. One of the goals of the Conference was to inform Government officials, planners and economists about the role of atomic energy and the main applications of isotopes and radiation in today's world. Consequently, the agenda was broader in some respects than those of the first three Conferences with a new emphasis on the practical problems of integrating nuclear power into national economies.

115. The 514 papers which were accepted for the ten general sessions and the 51 technical sessions will be reproduced in the Proceedings of the Conference, which are being published by the Agency. Nine volumes had been issued by 30 June 1972.

116. The papers presented to the Conference by some of the developing countries showed that they were planning to add nuclear power stations to their electrical grids, if this could be done at reasonable costs. The Conference confirmed the Agency's earlier findings that there was considerable interest in developing countries in small- and medium-sized reactors that would best fit into their electrical grids.

Publications

117. The relative share of various programmes in the publications issued is shown in the following table.

Table 19

Publications

Subject	1969 %	1970 %	1971 %
Nuclear power and reactors	14	13.5	8.5
Nuclear research	29	14.5	22
Nuclear safety and environmental protection	8	14	17
Food and agriculture	11.5	7.5	8
Life sciences	9.5	5	11.5
Theoretical physics	4	3.5	2
Public information	4	4	5
References and miscellaneous	20	38	26

118. Revenues from the sale of publications and related material amounted to $277 500 in 1971, compared with $221 350 in 1970. The commercial value of publications distributed free to Member States was $440 000.

SAFEGUARDS AND THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS

General

119. Some of the steps taken to begin the practical implementation of NPT are described below:

(a) On the basis of the Board's directive the text of a model agreement [13] has been formulated and sent to States that have opened negotiations;

(b) Teams have been appointed for negotiating safeguards agreements with non-nuclear-weapon States party to NPT, with EURATOM and its non-nuclear-weapon Member States, and in respect of the United Kingdom and the United States offers to place nuclear material in certain facilities under safeguards;

(c) A model text of a "Subsidiary Arrangement" to the standard agreement has been drawn up and sent to States and steps have been taken to prepare and standardize the facility attachments which must be drawn up for each plant, wherever safeguarded material will be used or stored;

(d) Five meetings of technical groups were held to define more precisely the technical objectives of safeguards under NPT and to provide relevant technical advice; and

(e) Experimental work done in Member States has provided useful data for improving the efficiency of safeguards.

120. Table 20 at the end of this section shows the status, as at 30 June 1972, of signatures, ratifications and accessions with respect to NPT, and the progress made in the negotiation of safeguards agreements in connection therewith.

121. On 20 September 1971 the Council of Ministers of EURATOM gave it a mandate to negotiate an agreement with the Agency which would enable its non-nuclear-weapon Member States to implement their eventual obligations under NPT. The negotiations started on 9 November 1971 and by 30 June 1972 there had been six rounds of discussion and very substantial progress had been achieved. The Parties were striving to complete the negotiations before the end of the summer.

Implementation of Agency safeguards

122. During the period covered by this report the Board approved:

(a) Safeguards agreements in connection with NPT with Bulgaria, Canada, Cyprus, the Czechoslovak Socialist Republic, Denmark, the German Democratic Republic, Greece, the Holy See, Hungary, Iceland, Iraq, Ireland, Lesotho, Malaysia, Mongolia, Nepal, New Zealand, Norway, Poland, Romania, Uruguay, Yugoslavia and the Republic of Zaire;

(b) A Safeguards Transfer Agreement in connection with the bilateral co-operation agreement between the Governments of Australia and Japan;

(c) A Safeguards Transfer Agreement in connection with the bilateral co-operation agreement between the Governments of France and Japan;

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[13] Reproduced in document INFCIRC/153.

(d) A Safeguards Transfer Agreement in connection with the bilateral co-operation agreement between the Governments of Sweden and the United States;

(e) A Safeguards Transfer Agreement in connection with the bilateral co-operation agreement between the Governments of Switzerland and the United States; and

(f) The negotiation and conclusion of an agreement to amend the Safeguards Transfer Agreement in connection with the bilateral co-operation agreement between the Governments of Brazil and the United States.

123. Table 21 shows the total number of safeguards agreements other than in connection with NPT, approved by the Board until 30 June 1972 and the parties involved.

124. Table 22 lists the facilities containing nuclear material at present under Agency safeguards; the breakdown on 30 June 1972 as compared to 30 June 1971 is as follows:

Facilities	30 June 1971	30 June 1972	
		NPT	Non-NPT
Nuclear power stations	9	6	15
Other reactors	66	41	67
Conversion plants, fabrication plants and fuel reprocessing plants	10	8	12
Other separate accountability areas	85	10	84

125. The following quantities of nuclear material were under Agency safeguards as of 31 December 1971:

	Total element	Fissionable isotope
(a) Special fissionable material		
Plutonium	1 726 kg	
Enriched uranium	522 862 kg	11 182 kg
(b) Source material		
Natural uranium	394 276 kg	
Depleted uranium	200 312 kg	
Thorium	227 kg	

126. 234 inspections were carried out in 19 States during the period covered by this report, compared with 184 inspections in 18 States during the preceding 12 months. 47 pre-operational visits were made in 13 States, including visits in connection with safeguards agreements under NPT, compared with ten pre-operational visits in seven States in the previous reporting period.

Notifications of transfer of nuclear materials

127. Notifications of international transfer of nuclear materials not under Agency safeguards were received from the following countries for the periods shown against them:

Canada	1 July 1970 to 30 June 1971
Norway	1 July 1970 to 30 June 1971
United States	1 July 1970 to 31 December 1971

Research and development programme

128. Under the Agency's research and development programme the following are some of the numerous internal studies made:

(a) Quantitative descriptions of the nuclear material systems in Member States up to 1980;

(b) The growth of safeguards effort between 1972 and 1976;

(c) The effect that the establishment of regional or smaller offices would have on safeguards manpower and cost requirements;

(d) Safeguards in relation to enrichment plants and related problems;

(e) Preparation of a technical safeguards manual;

(f) Requirements for setting up a network of national analytical laboratory services. Member States have been invited to take part in this network;

(g) Technical requirements for an Agency laboratory to enable the Agency to make periodic assessments of the limits of errors in the results of analyses of samples performed by other laboratories; and

(h) Computer programme for processing, storing and retrieving information in accountancy reports and for preparing statements based on those reports.

129. The following working groups and panels met during the year:

(a) A research co-ordination meeting on gamma spectrometry instrumentation and techniques (August/September 1971). This meeting gave guidance on the use of portable instruments and on the assaying of nuclear material;

(b) A technical working group on quantitative data and on results of systems analysis and integral tests (October 1971). This gave guidance on the standards to be followed in accounting for nuclear material in States and facilities;

(c) A group of consultants in November 1971 and a panel in 1972 helped to draw up guidelines for the physical protection of nuclear material against theft, loss, etc. The expert advice provided will be useful in replying to enquiries from Member States; and

(d) In April 1972 a working group on the use of isotopic composition data in safeguards discussed, inter alia, problems of the application of the isotopic correlations technique in the fuel cycle and the dynamic determination of the in-process inventory. As a result of this meeting valuable guidance was provided for establishing the isotopic composition data which may be used in the verification procedures.

130. Special attention was also devoted to the question of the implementation of safeguards on nuclear material in uranium enrichment plants, with a view to preparing for the eventual operation of such plants in non-nuclear-weapon States that have concluded or are negotiating relevant safeguards agreements with the Agency.

131. Studies have been carried out within the Secretariat to develop tentative safeguards procedures for such plants within the guidelines of the system laid down in the model agreement[13]. These studies dealt with:

(a) The different process schemes, plant capacities and magnitude of the flows and inventories;

(b) The definition of the suitable Material Balance Areas, taking into account the limited access to certain areas;

(c) The selection of Key Measurement Points;

(d) Measurement uncertainties at the different Key Measurement Points;

(e) The expected uncertainty of the book inventory and the material balance;

(f) Principles of the containment and surveillance measures;

(g) The design information, records and reports requirements; and

(h) The inspection purpose specific to this type of facility.

132. These studies have been used as a basis for the discussions of a technical working group on safeguards procedures for isotopic enrichment facilities which met in June 1972. During this meeting information was collected on gas diffusion and centrifuge plants, as regards processes, and design and operational features relevant to safeguards; and operators' accountancy procedures. This information will enable the Agency to further develop safeguards procedures. The working group also discussed potential containment and surveillance procedures, design information and records and reports requirements and design criteria which would facilitate safeguards.

133. In conclusion, the working group made the following recommendations:

(a) The working group should meet again in one to two years' time to review specific questions and the progress of work on safeguarding enrichment facilities;

(b) The effectiveness of containment/surveillance devices, and particularly instruments for monitoring quantities of nuclear material, should be developed and demonstrated;

(c) Co-operation between operators, developers of equipment and the organizers of safeguards application should be established; and

(d) The collection of data should be continued.

134. It should be pointed out that non-destructive instrumentation techniques for ^{235}U assay in UF_6 cylinders, which are currently being developed, serve the purpose of developing techniques for isotopic enrichment plants.

135. The following are some of the tests, experiments and similar projects that have been carried out in Member States with the co-operation of the Agency:

(a) Data were obtained for estimating the isotopic content of irradiated fuel while it was being processed at the Eurochemic reprocessing plant at Mol (Belgium),

in a project that involved co-operation with EURATOM and the Belgian Centre for Nuclear Energy Studies. The data are likely to be important for identifying the nuclear power plant in which the fuel has been used and in accounting for material while it is being reprocessed;

(b) At the Westinghouse Nuclear Fuel Division Uranium Oxide Conversion and Fabrication Plant at Columbia, South Carolina (United States), an integral test was made with the agreement of the United States Atomic Energy Commission to obtain a quantitative statement of the amount of "material unaccounted for" during the manufacture of a selected consignment of nuclear fuel as well as limits of error involved in the statement;

(c) In co-operation with the United Kingdom authorities a study at the Springfields Natural Uranium Fuel Fabrication Plant illustrated problems that arise in defining "material balance areas" within nuclear plants and in detecting material unaccounted for;

(d) In an experiment sponsored by the United States Atomic Energy Commission at the Plutonium Fuel Development Laboratory of the General Electric Company's Nuclear Centre at Vallecitos, California, the feasibility of combined chemical and non-destructive testing devices for measuring fully (instead of estimating) a material balance was demonstrated. The experiment also helped to develop procedures which will be applied in conversion plants and fabrication plants that process highly enriched fuel;

(e) With the co-operation of the authorities of the Soviet Union studies and tests were made at the Novo-Voronezh Nuclear Power Station of advanced safeguards procedures for light-water reactors. The procedures developed were demonstrated at the power station while Agency inspectors were present as observers;

(f) In co-operation with the Belgian Centre for Nuclear Energy Studies a non-destructive technique was developed for determining rapidly the degree of enrichment of uranium in uranium oxide powder; and

(g) Tests and evaluations of equipment were carried out in co-operation with the United States Atomic Energy Commission at a General Electric Company reprocessing plant in Morris (United States), as well as in Canada, with the co-operation of the Canadian authorities, and at Mol in Belgium. The last-mentioned test was an inter-laboratory project that involved co-operation with the Nuclear Research Centre of Karlsruhe (Federal Republic of Germany), EURATOM and the Belgian Centre for Nuclear Energy Studies.

136. Equipment that has been developed has included:

(a) A compact portable gamma spectrometer system. This is in routine use chiefly for the analysis of the isotopic content of fabricated fuel before use;

(b) Camera surveillance equipment which has been routinely used for surveying reactors in India, Japan and Spain during shut-downs and in Spain during reactor operation also; and

(c) High-power tele-objective cameras to identify serial numbers of spent fuel in storage ponds. The cameras were successfully tested in Spain with the co-operation of the Spanish authorities.

137. Research and technical contracts being carried out with the Agency's support are summarized in Table 23.

Table 20

Situation on 30 June 1972 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		
Austria	28 June 1969	In force: 23 July 1972
Barbados		
Belgium		Under negotiation
Bolivia	26 May 1970	
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	
Ceylon		
Chad	10 March 1971	
China, Republic of	27 January 1970	
Colombia		
Costa Rica	3 March 1970	Under negotiation
Cyprus	16 February 1970	Signed: 26 June 1972
Czechoslovak Socialist Republic	22 July 1969	In force: 3 March 1972
Dahomey		
Denmark	3 January 1969	In force: 1 March 1972
Dominican Republic	24 July 1971	
Ecuador	7 March 1969	Under negotiation
Egypt, Arab Republic of		
El Salvador		
Ethiopia	5 February 1970	
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		Under negotiation
Ghana	5 March 1970	Under negotiation
Greece	11 March 1970	Provisionally in force: 1 March 1972
Guatemala	22 September 1970	Under negotiation
Haiti	2 June 1970	
Holy See	25 February 1971	Signed: 26 June 1972
Honduras		
Hungary	11 March 1970	In force: 30 March 1972
Iceland	18 July 1969	Approved by the Board

(1)	(2)	(3)
Indonesia		
Iran	2 February 1970	Under negotiation
Iraq	29 October 1969	In force: 29 February 1972
Ireland	1 July 1968	In force: 29 February 1972
Italy		Under negotiation
Ivory Coast		
Jamaica	5 March 1970	Under negotiation
Japan		
Jordan	11 February 1970	Under negotiation
Kenya	11 July 1970	Under negotiation
Korea, Republic of		
Kuwait		
Laos	20 February 1970	Under negotiation
Lebanon	15 July 1970	Under negotiation
Lesotho	20 May 1970	Approved by the Board
Liberia	5 March 1970	
Libyan Arab Republic		
Luxembourg		Under negotiation
Madagascar	8 October 1970	Under negotiation
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	Negotiation completed
Mexico	21 January 1969	Negotiation completed
Mongolia	14 May 1969	Approved by the Board
Morocco	30 November 1970	Under negotiation
Nepal	5 January 1970	In force: 22 June 1972
Netherlands		Under negotiation
New Zealand	10 September 1969	In force: 29 February 1972
Nicaragua		
Nigeria	27 September 1968	Under negotiation
Norway	7 March 1969	In force: 1 March 1972
Panama		
Paraguay	4 February 1970	
Peru	3 March 1970	
Philippines		
Poland	12 June 1969	Signed: 8 March 1972
Romania	4 February 1970	Signed: 8 March 1972
San Marino	10 August 1970	
Senegal	17 December 1970	Under negotiation
Sierra Leone[b/]		Under negotiation
Singapore		
Somalia	5 March 1970	Under negotiation
Southern Yemen		

(1)	(2)	(3)
Sudan		
Swaziland	11 December 1969	Under negotiation
Sweden	9 January 1970	Under negotiation
Switzerland		
Syrian Arab Republic	24 September 1969	
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	30 March 1970	Under negotiation
Yemen, Arab Republic of		
Yugoslavia	3 March 1970	Signed: 26 May 1972
Zaire, Republic of	4 August 1970	Signed: 1 March 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 21

Safeguards Agreements in force as of 30 June 1972
other than those in connection with NPT

Party(ies)[a]	Subject	Entry into force	INFCIRC
Project Agreements			
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	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
Spain	Coral I Reactor	23 Jun 1967	99
Uruguay[b]	URR Reactor	24 Sep 1965	67
Viet-Nam	VNR-1 Reactor	16 Oct 1967	106
Yugoslavia[b]	TRIGA II Reactor	4 Oct 1961	32
Zaire, Republic of[b]	TRICO Reactor	27 Jun 1962	37
Transfer Agreements (Agreements for transfer of safeguards under bilateral co-operation agreements between the indicated Parties)			
Argentina/USA		25 Jul 1969	130
Australia/USA		26 Sep 1966	91
Australia/Japan			
Austria[b]/USA		24 Jan 1970	152
Brazil/USA[c]		31 Oct 1968	110
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			
Greece[b]/USA		13 Jan 1966	78
India/USA		27 Jan 1971	
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[c]		5 Jan 1968	111
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
Unilateral submissions			
China, Republic of	Taiwan Research Reactor Facility	13 Oct 1969	133
Mexico	All nuclear activities	6 Sep 1968	118

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 20).

c/ This agreement will require amendment, authorization for which has already been

Table 22

Nuclear installations under Agency safeguards or containing safeguarded material under agreements approved by the Board of Governors

A. Reactors[a] other than power reactors

State in which located	Name of reactor	Location	Type	Capacity MW(th)	In operation
Argentina	RA-0/Argentine Reactor 0	Cordoba	Tank	.00	x
	RA-1/Argentine Reactor 1	Constituyentes	Argonaut	.10	x
	RA-2/Argentine Reactor 2	Constituyentes	Argonaut	.00	x
	RA-3/Argentine Reactor 3	Ezeiza	Pool-tank	5.00	x
	SUR-100	Rosario	Solid-homogeneous	.00	
Australia	HIFAR	Lucas Heights, N.S.W.	Tank	10.00	x
	MOATA	Lucas Heights, N.S.W.	Argonaut	.10	x
	CRITICAL FACILITY	Lucas Heights, N.S.W.	Crit. Fac.	.00	
Austria[b]	SAR Argonaut	Graz	Argonaut	.001	x
	Austria Triga Mark II	Vienna	Triga II	.25	x
	Astra	Seibersdorf	Pool	12.00	x
Brazil	IEAR-1	São Paulo	Pool	5.00	x
	TRIGA-1	Belo Horizonte	Triga I	.03	x
	ARGONAUT	Rio de Janeiro	Argonaut	.01	x
Bulgaria[b]	IRT-2000	Sofia	Pool	2.00	x
Canada[b]	NRX Reactor	Chalk River, Ont.	NRX	30.00	x
	NRU Reactor	Chalk River, Ont.	NRU	125.00	x
	WR-1 Reactor	Pinawa, Manitoba	Organic-cooled	60.00	x
	McMaster Nuclear Reactor	Hamilton, Ont.	Pool-type	2.5	x
	Slowpoke-1	University of Tor.	Pool-type	.005	x
	Slowpoke-2	Ottawa, Ont.	Pool-type	.020	x
	PTR	Chalk River, Ont.	Pool-type	.0001	x
	ZED-2	Chalk River, Ont.	Pool-type	.0002	x
Chile	Herald Reactor	Santiago	Herald	5.00	
China	THOR/Tsing Hua Open Pool Reactor	Hsin-chu	Pool	1.00	x
	Taiwan Research Reactor Facility	Huaitzupu	NRX	40.00	
	ZPRL/Zero Power Reactor	Lung-Tan	Pool	.00	x
Colombia	IAN-R1	Bogotá	Light-water	.10	x
Czechoslovak Socialist Republic[b]	SR-0	Vochov	CA	.00	x
	VVR-S Research Reactor	Rez	Tank	4.00	x
	TR-0 Critical Assembly	Rez	CA	.00	
Denmark[b]	DR-1	Risø	Homogeneous	.002	x
	DR-2	Risø	Pool	5.00	x
	DR-3	Risø	Tank	10.00	x
Finland[b]	FiR-1	Otaniemi	Triga II	.25	x
German Democratic Republic[b]	WWR-S(m)	Rossendorf	Tank	6.00	x
	Rake II	Rossendorf	Tank	10.00	x
	RRR	Rossendorf	Critical Ass.	.5	x
Greece[b]	GRR/Greek Research Reactor	Athens	Pool	5.00	x
Hungary[b]	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	TRIGA II/Bandung	Bandung	Triga II	1.00	x
Iran	UTRR	Teheran	Pool	5.00	x
Iraq[b]	No name (IRT-2000 type)	Baghdad	Pool	2.00	x
Israel	IRR-1	Yaven	Pool	5.00	x

State in which located	Name of reactor	Location	Type	Capacity MW(th)	In operation
Japan	JRR-2/Japan Research Reactor 2	Tokai-Mura	Tank	10.00	x
	JRR-3/Japan Research Reactor 3	Tokai-Mura	Tank	10.00	x
	JRR-4/Japan Research Reactor 4	Tokai-Mura	Pool	1.00	x
	JPDR/Japan Power Demonstration Reactor	Tokai-Mura	Boiling-water	90.00	Under reconstruction
	SHCA/Semi-Homogeneous Crit. Assembly	Tokai-Mura	Crit. Fac.	.00	x
	AHCF/Aqueous Homogeneous Crit. Facility	Tokai-Mura	Crit. Fac.	.00	x
	TCA/Tank-type Crit. Ass.	Tokai-Mura	Crit. Fac.	.00	x
	Rikkyo University Research Reactor	Tokosuka-shi	Triga II	.10	x
	Musashi College of Technology Res. Reactor	Kawasaki-shi	Triga II	.10	x
	Kinki University Research Reactor	Fuse-shi	UTR-B	.00	x
	TTR/Toshiba Training Reactor	Kawasaki-shi	Pool	.03	x
	HTR/Hitachi Training Reactor	Kawasaki-shi	Pool	.10	x
	HCA/Hitachi Critical Ass.	Kawasaki-shi	Crit. Fac.	.10	x
	Nippon Atomic Industry Group Crit. Assembly	Kawasaki-shi	Crit. Fac.	.00	x
	KUR/Kyoto University Research Reactor	Kumatori-cho	Pool	1.00	x
	JMTR-CA/Japan Material Testing Reactor Crit. Fac.	Tokai-Mura	Crit. Fac.	.00	x
	FCA/Fast Critical Assembly	Tokai-Mura	Crit. Fac.	.00	x
	JMTR/Japan Material Testing Reactor	Oarai	Tank	50.00	x
	Mitsubishi Crit. Facility	Ohmiya-Saitana	Tank	.00	x
	Deuterium Critical Assembly	Oarai-Ibaraki	Tank	.00	
	TODAI Research Reactor	Tokai-Mura	Fast Neutron Source Reactor	.002	x
Korea, Republic of	TRIGA II/Seoul	Seoul	Triga II	.10	x
Mexico	National Institute of Nuclear Energy Reactor	Mexico City	Triga III	1.00	x
Norway[b/]	JEEP-II	Kjeller	Tank	2.00	x
	HBWR	Halden	HBWR	25.00	x
Pakistan	PRR/Pakistan Research Reactor	Rawalpindi	Pool	5.00	x
Philippines	PRR-1/Philippine Research Reactor	Diliman, Quezon City	Pool	1.00	x
Poland[b/]	EWA	Świerk	Tank	8.00	x
	Maryla	Świerk	CA	.00	x
	Anna	Świerk	CA	.00	x
	Agata	Świerk	CA	.00	x
Portugal	RPI/Portuguese Research Reactor	Sacavem	Pool	1.00	x
Romania[b/]	VVR-S	Margurele	Tank	3.5	x
	Helen	Margurele	SCA	.00	x
South Africa	SAFARI-1	Pelindaba	Tank	20.00	x
Spain	JEN-1	Madrid	Pool	3.00	x
	JEN-2	Madrid	Pool	.001	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
	Ågesta	Stockholm	PHWR	80.00	x

State in which located	Name of reactor	Location	Type	Capacity MW(th)	In operation
Switzerland	Proteus	Würenlingen	Fast thermal CA	.00	
	Saphir	Würenlingen	Pool	5.00	x
	Diorit	Würenlingen	HW	30.00	
	Crocus	Lausanne	CA	$.10^{-3}$	x
	AGN201P	Geneva		.00	x
	AGN211P	Basel	Pool	.00	x
Thailand	TRR-1/Thai Research Reactor 1	Bangkok	Pool	1.00	x
Turkey	TR-1	Istanbul	Pool	1.00	x
United Kingdom	Zebra Fast Critical Ass.	Winfrith	Crit. Fac.	.00	x
Uruguay[b/]	URR/Uruguay Research Reactor	Montevideo	Lockheed	.10	
Venezuela	RV-1	Caracas	Pool	3.00	x
Viet-Nam	VNR-1/Viet-Nam Res. Reactor 1	Dalat	Triga II	0.25	x
Yugoslavia[b/]	Triga Mark II/Yugoslav Res. Reactor	Ljubljana	Triga II	0.25	x
	RA	Vinča	Heavy-water	6.5	x
	RB	Vinča	Crit. Fac.	.00	x
Zaire, Republic of[b/]	Triga Mark II	Kinshasa	Triga II	1.00	(Final stage of construction)

B. Nuclear power stations

State in which located	Name of power station	Location	Type	Capacity MW(th)	In operation
Canada[b/]	Pickering Generating Station	Pickering, Ontario	Candu	2000	x
	NPD Generating Station	Ralphton, Ontario	Candu	22	x
	Gentilly Power Station	Gentilly, Quebec	Candu	250	x
	Douglas Point Power Station	Kincardine, Ontario	Candu	208	x
Czechoslovak Socialist Republic[b/]	Nuclear Power Plant Bohunice	Taslovske	HWGC	150	
German Democratic Republic[b/]	Rheinsberg N. P. S.	Rheinsberg	PWR	80	x
India	Tarapur Atomic Power Station	Tarapur	BWR	380	x
	Rajasthan Atomic Power Station	Rajasthan	Candu	400	
Japan	Tokai-Mura Nuclear Power Station	Tokai-Mura	Magnox	185	x
	Tsuruga Nuclear Power Station	Tsuruga	BWR	320	x
	Mihama-1 Nuclear Power Station	Mihama-Fukui	PWR	340	x
	Fukushima-1 Nuclear Power Station	Ohkumo-Fukushima	BWR	460	x
	"Mutsu" Nuclear Ship	Harbour near Mutsu City	PWR	36	
	Mihama-2 Nuclear Power Station	Mihama-Fukui	PWR	500	
Pakistan	Karachi Nuclear Power Project	Karachi	Candu	137	x
Spain	"José Cabrera" Nuclear Power Station	Almonacid de Zorita	PWR	160	x
	Santa Maria de Garona Nuclear Power Station	Santander	BWR	450	x
Sweden	Oskarshamn	Oskarshamn	BWR	440	x
Switzerland	Mühleberg	Mühleberg	BWR	306	x
	Beznau I		PWR	350	x
	Beznau II		PWR	350	x

C. Conversion plants, fabrication plants and chemical reprocessing plants

Argentina	Pilot Fuel Reprocessing Plant, Ezeiza Pilot Fuel Fabrication Plant, Constituyentes, A Pilot Scrap Recovery Plant, Buenos Aires
Brazil	Fabrication Facility, Metallurgy Department, Instituto de Energia Atomica, São Paulo
Canada[b/]	Eldorado Nuclear Limited Port Hope Refinery Westinghouse Fuel Fabrication Plant Canadian General Electric Pelletizing Facility Canadian General Electric Fabrication Plant
Czechoslovak Socialist Republic[b/]	Uranium Industry Chemical Plant, Mydlovary Nuclear Fuel Institute, Zbraslav
Denmark[b/]	Metallurgy Department, Risø
Japan	Sumitomo Electric Industry (Kumatori-1) Furukawa Electric Industry (Takeyama-1) Mitsubishi Atomic Power Industry (Ohmiya-1) Japan Nuclear Fuel Corporation Mitsubishi Nuclear Fuel Co.
Norway[b/]	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/ As defined in documents INFCIRC/26, Part II, para. 14 and INFCIRC/66/Rev. 2, Part IV, para. 80.

b/ NPT Safeguards Agreement.

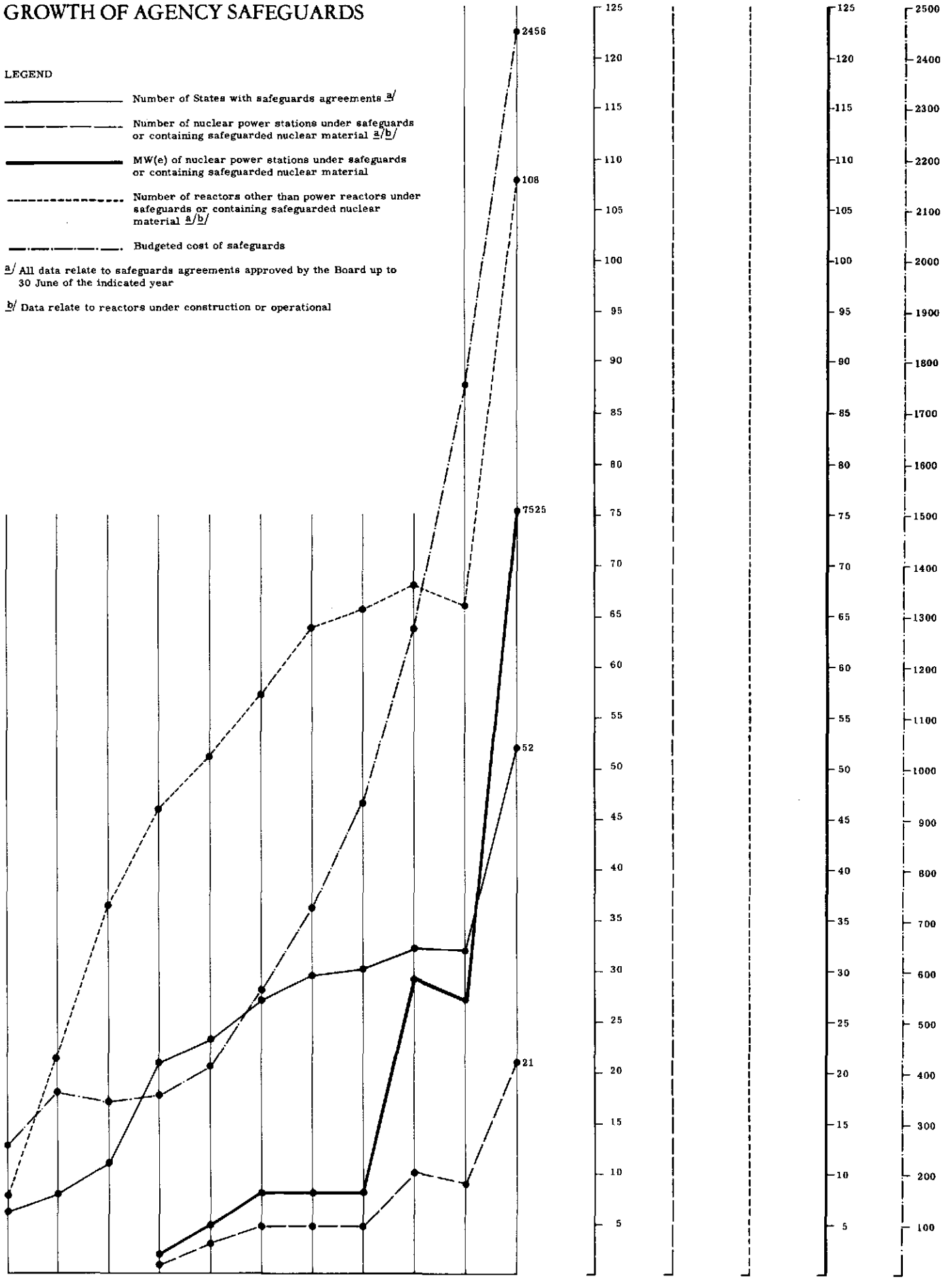
Table 23

Contracts for safeguards research and development

Title	Institute	Agency contribution in dollars
Development of an application technique to verify the fissile material of an irradiated fuel in a zero power reactor	UKAEA, Reactor Group HQ., Risley, United Kingdom	5 000
Integral safeguards experiment at the Novo-Voronezh LWR power reactor plant	I. V. Kurchatov Institute of Atomic Energy and Novo-Voronezh Nuclear Power Station, Soviet Union	40 000
Fingerprinting and containment of fuel elements for safeguards of an Atucha type	Comision Nacional de Energia Atomica, 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'études de l'énergie nucléaire, Mol, Belgium	13 000
Verification of reprocessing input measurements	Eurochemic, Mol, Belgium	4 000
Development, demonstration and application of non-destructive instrumental techniques for assay of special nuclear material during fabrication of LWR fuel	Centre d'études de l'énergie nucléaire, Mol, Belgium	2 500
Determination of ^{235}U enrichment in unirradiated uranium bearing streams	Institute of Physics Bulgarian Academy of Science Sofia	6 500
Development and fabrication of probes and auxiliary equipment for measurement of Pu using neutron coincidence counting technique	Institute of Physics Bulgarian Academy of Science Sofia	4 200
Safeguarding the input to a fuel reprocessing plant	Gesellschaft für Kernforschung Karlsruhe, Federal Republic of Germany	8 000
Systems study of safeguards in enrichment plants	Central Research Institute for Physics, Hungarian Academy of Sciences, Budapest	5 500
Study of a non-destructive measurement method for highly enriched U-Al alloy plant 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	5 500
Feasibility and study of determining the content of the input accountability vessel by a weighing technique	Power Reactor and Nuclear Fuel Development Corporation, Tokyo	5 000
Feasibility study for the safeguards use of NMR method for the isotopic assay of ^{235}U in UF_6 streams with different enrichments	Institute of Atomic Physics Bucharest	5 720
Evaluation of operational data on a Swedish low	ASEA-ATOM Fuel Fabrication	2 500

Title	Institute	Agency contribution in dollars
Chromatographic separation of uranium and plutonium from reprocessing plant liquid waste followed by automatic measurement of plutonium amounts by probe type alpha detector and the uranium by photometry methods	Vernadsky Institute of Geochemistry and Analytical Chemistry, Moscow	25 000
Measurement of neutron decay constant in a highly subcritical reactor as a safeguards method	Institute of Nuclear Energetics Academy of Sciences Minsk-Sosni, Soviet Union	nil
Nuclear material transfer monitor	United Kingdom Atomic Energy Authority, Risley, United Kingdom	9 300
Development of an optical instrument and technique to indicate tampering with reactor fuel assemblies	Battelle Northwest Laboratory Richland, Washington, United States	31 000
Tamper-resistant instrumentation for a chemical reprocessing plant	Braddock, Dunn and McDonald Inc. McLean, Virginia	19 900
Service contract with GE on installation of time domain reflectometry probe	General Electric Co., San José California, United States	9 000
Consultancy agreement on safeguards instrumentation at Bradwell	Bradwell Nuclear Power Station and Central Electricity Generating Board, United Kingdom	2 000

GROWTH OF AGENCY SAFEGUARDS



ADMINISTRATION

EXTERNAL RELATIONS AND LEGAL MATTERS

138. The main developments in external relations and legal matters are referred to in the Introduction and in the chapters on technical programmes, especially Safeguards and NPT.

139. On 9 December 1971 the Board adopted a resolution with regard to the representation of China in the Agency, similar to that adopted by the General Assembly of the United Nations on 25 October 1971. All technical co-operation and research support activities in Taiwan have been discontinued or are being wound up during the course of 1972.

140. On 30 June 1972 the Treaty for the Prohibition of Nuclear Weapons in Latin America (the Tlatelolco Treaty) was in force between 19 States, of which two had concluded the required safeguards agreements with the Agency. Two non-Latin American States had ratified the Additional Protocol I to the Treaty with respect to territories under their responsibility in the region. An agreement for co-operation between the Agency and OPANAL is being submitted by the Board to the General Conference for approval. [14]

141. The co-operation agreement between the Agency and the League of Arab States was signed and entered into force on 15 December 1971. The Agency has thus concluded agreements of this kind with NEA, the Inter-American Nuclear Energy Commission, the Organization of African Unity and the League of Arab States [15], as well as with eight organizations in the United Nations system.

142. The Agency contributed background papers, one in collaboration with WHO, to the United Nations Conference on the Human Environment and participated in the Conference at Stockholm in June 1972. As regards international organizational implications of the action plan recommended by the Conference, the Agency's representative expressed the view that the terms of reference of the proposed new machinery should be formulated in such a way as not to infringe upon the statutory rights and obligations of the Agency's governing bodies.

143. Consultations were held between the Agency/UNIDO and the joint stock company established in May 1971 to plan, establish and finance the permanent Headquarters of the international organizations and a conference centre at the Donaupark in Vienna. Agreement has been reached regarding space and functional requirements, and it is expected that construction work will begin towards the end of 1972.

144. A joint Agency/IMCO/NEA International Diplomatic Conference, held at Brussels from 29 November to 3 December 1971, elaborated the text of a Convention Relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material. On 30 June 1972, eight States had signed the Convention. Its purpose is to ensure that if an incident occurs when nuclear material is being carried by sea, all liability will be channelled to the operator of the nuclear installation for damage arising therefrom and none to the carrier. Hitherto, the possibility of liability falling on the carrier has proved to be a serious obstacle in arranging for the shipment of nuclear material.

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[14] GC(XVI)/481.

[15] The texts of these agreements are reproduced in documents INFCIRC/25 and INFCIRC/25/Add. 2 and 3.

145. The Conference was followed up by an Agency/NEA symposium on the maritime carriage of nuclear material, at Stockholm in June 1972, which discussed the technical and legal aspects of the problem and, particularly, techniques for packing and transporting nuclear material, the effect of changes in international and national regulations and the consequences of the legal situation created by the 1971 Brussels Convention.

146. The Agency provided advice to Indonesia, New Zealand, the Philippines and Thailand on nuclear safety regulations and, in particular, licensing systems for nuclear power plants. Lawyers from eight developing Member States were trained in regulatory and liability aspects of nuclear energy at the Agency's Headquarters.

147. An Agency/FAO/WHO group on the legal aspects of food irradiation, met at Vienna from 20 to 24 March 1972; it drew up recommendations regarding the principles to be applied in regulating the marketing of irradiated foodstuffs.

148. During the period covered by this report Ireland and Luxembourg accepted the Agreement on the Privileges and Immunities of the Agency [16] raising to 41 the number of Member States party to the Agreement.

PERSONNEL

149. On 30 June 1972 the Secretariat had 344 staff members in the Professional and higher categories, 556 General Service staff and 227 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 54 as compared to 55 on 30 June 1971.

150. The Agency has provided the Special Committee for the review of the United Nations salary system with statistical data and other information on the Agency's practices and experiences. In July 1971 representatives of the Director General appeared before the Committee and outlined his views on changes in the salary system.

151. The Director General's views regarding the desirable changes in the salary system and other conditions of service as well as the structure of the service have already been expressed in several forums. The Special Committee has shown interest in some of the ideas expressed by the Director General, especially the view that salaries for Professional staff should be determined with reference to the salary rates prevailing in several countries. It requested additional information regarding certain aspects of the proposal. The Agency also replied to certain specific questions put to it by the Committee regarding the structure of the service, grading, conditions in the field.

152. In 1971 the Director General decided to make certain changes in the organizational structure of the Secretariat to bring together areas of work, which are closely connected, into single Divisions. These changes reflect the results of previous staff studies which have continued in the period under review. For this purpose the Agency has availed itself of the services of experts placed at its disposal by Member Governments.

153. The following organizational chart shows the structure of the Secretariat as at 30 June 1972.

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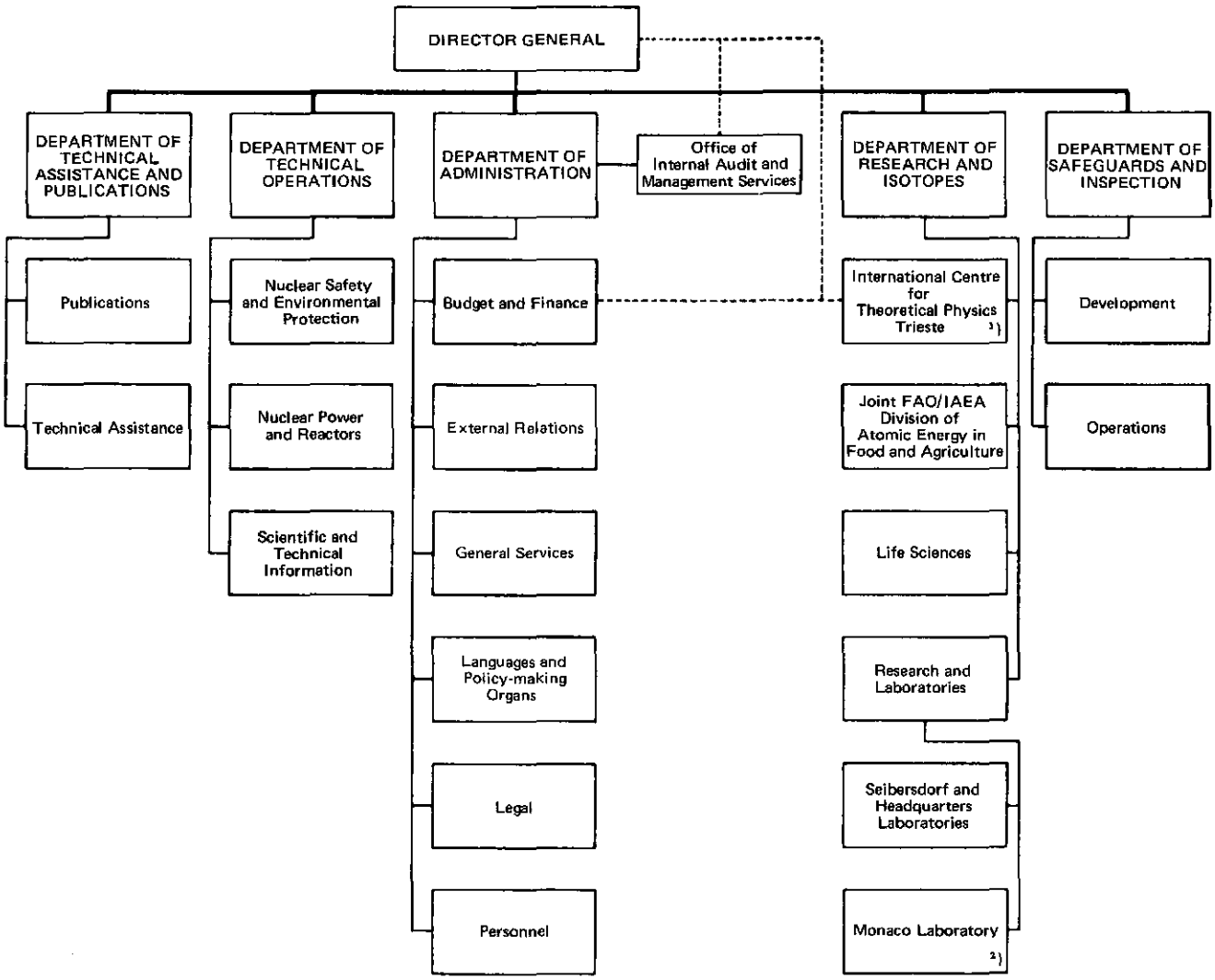
[16] INFCIRC/9/Rev. 2.

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 1971

154. The original assessment of contributions on Member States included in the scale of assessment for 1971 amounted to $13 052 000. Due to the withdrawal of Nicaragua on 14 December 1970, after the General Conference had approved the scale of assessment for the year 1971, the original assessment was reduced by $5221 to $13 046 779.

155. At its fifteenth (1971) regular session the Conference approved a supplementary budgetary appropriation for 1971 [17] of $730 000 to be financed as follows:

(a) $136 258 from the cash surplus in respect of the year 1969;

(b) $13 742 from miscellaneous income for the year 1971 not already taken into account in the Regular Budget;

(c) $300 000 as a result of a reduction in the level of the Working Capital Fund from $2 million to $1.7 million; and

(d) $280 000 to be temporarily withdrawn from the Working Capital Fund, but to be recouped by means of a special assessment on Member States.

156. In December the Board was informed that it appeared unlikely that the amount mentioned in sub-paragraph (d) above would be required, and that the assessment would not be made. At the end of December it was found that neither items (b) nor (d) were required.

157. By 31 December 1971, the Agency received Member States' contributions towards the Regular Budget for 1971 amounting to $12 201 519, including the reduction of the Working Capital Fund referred to in sub-paragraph (c) above, which represents 91.42% of the total amount assessed. By 30 June 1972 $12 511 933 or 93.74% of the 1971 Regular Budget assessment had been received.

158. The Agency's obligations for 1971 amounted to $14 010 024, which resulted in budgetary savings of $204 234 from the appropriation for 1971. A further amount of $297 279 from miscellaneous income and minor adjustments due to the withdrawal of a Member State brought the total provisional budgetary surplus on 31 December 1971 to $496 172 [18]. Since contributions in the amount of $1 145 140 were outstanding from Member States for 1971, there was a provisional cash deficit of $648 968.

159. Savings under two appropriation sections totalling $345 227 were transferred to six other appropriation sections which bore the major impact of salary increases approved in 1971.

The financial year 1972

160. The Conference approved the scale of assessment and Regular Budget appropriations for 1972 which involved assessment on Member States of an amount of $15 392 000. [19]

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[17] GC(XV)/RES/279.

[18] See Statement I.C of the Agency's Accounts for 1971, document GC(XVI)/484.

[19] GC(XV)/RES/284 and 280 respectively.

161. By 30 June 1972 the following advances to the Working Capital Fund and contributions to the Regular Budget for 1972 had been received:

Advances to the Working Capital Fund	$1 666 680
Contributions to the Regular Budget for 1972	$5 665 882

By that date Member States had thus paid 98.04% of the total required advances to the Working Capital Fund and 36.81% of the total contributions due to the 1972 Regular Budget.

Operational Budget

162. Although the Conference at its fourteenth (1970) regular session increased the target for voluntary contributions from $2 to $2.5 million, there was a shortfall of approximately $349 000 in the actual pledges made by Member States. Of a total amount of $2 151 375 pledged to the General Fund for 1971, $1 919 040 had been paid by 31 December 1971. By June 1972 receipts amounted to $2 103 986 leaving a balance of $47 389 still to be paid.

163. The total operational obligations incurred during 1971 amounted to $3 195 168. Unliquidated obligations as at 31 December 1971 including obligations brought forward from the previous years amounted to $1 735 972.

The Agency's resources in 1971

164. Resources equivalent to more than $20 million were at the Agency's disposal during 1971 under its own programme, UNDP(TA) and UNDP(SF) accounts and other special projects, including contributions in cash, services and kind. Details concerning these resources are included in the Agency's Accounts for 1971. [20]

[20] Document GC(XVI)/484.

THE BOARD OF GOVERNORS

To 27 September 1971	1971-1972	From 27 September 1971
	Argentina[a/b/]	
	Australia[a/b/]	
Belgium[c/]		
	Brazil[d/]	
	Canada[a/b/]	
		Ceylon[e/]
	Chile[d/]	
		China[e/]
		Colombia[e/]
		Czechoslovak Socialist Republic[f/]
Denmark[c/]		
		Egypt, Arab Republic of[e/]
	France[a/b/]	
		Greece[e/]
Hungary[g/]		
	India[a/b/]	
	Japan[a/b/]	
Morocco[g/]		
	Netherlands[d/]	
Nigeria[g/]		
		Norway[f/]
Pakistan[g/]		
Poland[c/]		
		Portugal[f/]
		Romania[e/]
	South Africa[a/b/]	
Spain[g/]		
	Syrian Arab Republic[a/]	
	Thailand[d/]	
	Union of Soviet Socialist Republics[a/b/]	
	United Kingdom of Great Britain and Northern Ireland[a/b/]	
	United States of America[a/b/]	
Uruguay[g/]		
Viet-Nam[g/]		
		Zaire, Republic of[e/]

a/ Designated by the Board on 9 June 1970 under Article VI. A. 1 of the Statute.
b/ Designated by the Board on 9 June 1971 under Article VI. A. 1 of the Statute.
c/ Designated by the Board on 9 June 1970 under Article VI. A. 2 of the Statute.
d/ Elected by the General Conference on 28 September 1970 under Article VI. A. 3 of the Statute.
e/ Elected by the General Conference on 27 September 1971 under Article VI. A. 3 of the Statute.
f/ Designated by the Board on 9 June 1971 under Article VI. A. 2 of the Statute.
g/ Elected by the General Conference on 29 September 1969 under Article VI. A. 3

ANNEX B

FELLOWSHIPS OFFERED OR PROVIDED FREE OF CHARGE IN 1971

Donor	Number of fellowships	
	Available	Awarded[a]
Member States		
Argentina	5	6
Austria	2	1
Belgium	6	4
Brazil	10	2
Bulgaria	2	-
China	2	-
Czechoslovak Socialist Republic	9	3
Denmark	5	1
Finland	1	1
France	10	10
Germany, Federal Republic of	—[b]	35
Greece	10[c]	-
Hungary	4	6
India	10	10
Israel	5[d]	1
Italy	20[e]	15
Japan	15[f]	7
Mexico	2	2
Netherlands	8	6
Philippines	2	2
Poland	10	6
Romania	11[g]	1
Spain	5	7
Sweden	—[h]	7
Switzerland	2	1
Thailand	2[i]	-
Union of Soviet Socialist Republics	—[h]	8
United States of America	50	52
Yugoslavia	5[j]	3
Sub-total	203	197
Regional organizations		
Joint Institute for Nuclear Research at Dubna, Soviet Union	3	3
Total	206	200

a/ Number of awards less rejections and withdrawals.

b/ No maximum number of openings was specified.

c/ Available to candidates nominated by countries participating in activities of the United Nations Economic Commission for Africa.

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/ Five of these were carried over from 1970.

g/ Carried over from the offer made in 1965.

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

i/ Available to candidates from the region.

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

ANNEX C

RESEARCH CONTRACTS

I. Total value of contracts in 1971

Year	New contracts	Renewals	Total	Value
1970	70	143	213	780 684
1971	76	118	198	698 205

II. Analysis by subject matter of contracts awarded or renewed in 1971

Subject matter of research	Number of contracts placed	Number of contracts renewed	Agency payment in dollars
Nuclear technology			
Nuclear power and reactors	13	4	78 550
Waste management	-	1	2 000
Physics and chemistry	11	5	54 210
Radioisotopes and radiation applications in			
Agriculture	22	32	166 525
Food technology	2	6	34 600
Hydrology	3	5	41 000
Industry	3	3	14 100
Medicine	7	27	136 830
Protection of man and his environment			
Health physics and radiation protection	5	12	62 990
Radiation biology	6	18	67 300
Environmental research	2	3	27 100
Dosimetry	2	2	13 000
Total	76	118	698 205

III. Analysis by country of contracts awarded or renewed in 1971

Country	Number of contracts placed	Number of contracts renewed	Agency payment in dollars
Argentina	3	5	30 625
Austria	2	3	15 200
Belgium	1	5	28 500
Brazil	1	1	8 800
Bulgaria	2	2	18 800
Burma	-	1	1 800
Ceylon	1	2	8 000
Chile	-	4	13 450
China	2	5	18 500
Czechoslovak Socialist Republic	2	5	25 500
Cyprus	1	-	7 000
Denmark	-	1	3 000
Ecuador	3	-	11 900
Egypt, Arab Republic of	2	2	17 000
Finland	1	-	2 000
France	1	1	5 600
Germany, Federal Republic of	-	1	5 000
Ghana	1	2	8 500
Greece	4	2	21 600
Hungary	1	6	24 660
Iceland	1	-	10 000
India	5	8	38 190
Indonesia	3	2	14 800
Iran	-	1	3 600
Iraq	1	2	8 900
Israel	3	2	15 500
Italy	1	1	7 750
Jamaica	1	-	4 000
Japan	-	1	2 000
Kenya	-	2	6 000
Korea, Republic of	4	4	25 000
Lebanon	-	1	7 000
Malaysia	1	-	3 500
Mexico	2	1	17 300
Morocco	-	-	600[a/]
Netherlands	-	2	6 000
Nigeria	-	5	16 680
Pakistan	-	3	8 800
Peru	1	1	11 400
Philippines	3	1	11 000
Poland	4	2	23 700
Portugal	-	2	6 000
Romania	3	3	21 600
Singapore	1	1	6 500
South Africa	-	1	4 000
Spain	1	1	10 500
Sweden	-	1	3 500
Switzerland	-	1	3 000
Thailand	3	4	21 200
Turkey	2	4	25 600
Uganda	1	2	10 000
Union of Soviet Socialist Republics	-	1	1 000
United Kingdom of Great Britain and Northern Ireland	-	2	4 700
United States of America	-	2	10 800
Uruguay	1	1	9 600
Viet-Nam	1	2	8 300
Yugoslavia	4	3	29 250
Zambia	1	-	5 500
Total	76	118	698 205

a/ Additional funds awarded in support of an active research contract.

ANNEX D

CONFERENCES, SYMPOSIA AND SEMINARS HELD DURING THE PERIOD 1 JULY 1971-30 JUNE 1972

Date and place	Title	Co-sponsoring organizations	Number of participants	Number of countries represented	Number of organizations represented	Number of papers presented
1971						
22-26 November Stockholm	Symposium on the Assessment of Radioactive Organ and Body Burdens	WHO	118	23	7	45
22 November-10 December Buenos Aires	Regional Seminar for Latin America on Input Preparation for INIS		28	7	1	-
29 November-3 December Vienna	Symposium on Analytical Methods in the Nuclear Fuel Cycle		118	27	5	42
13-17 December Vienna	Symposium on the Use of Isotopes and Radiation in Research on Soil-Plant Relationships, including Applications in Forestry	FAO	116	34	6	55
1972						
17-21 January Vienna	Seminar on Numerical Reactor Calculations		112	28	5	24
6-10 March Grenoble, France	Symposium on Neutron Inelastic Scattering		215	24	2	69
20-24 March Athens	Symposium on the Use of Isotopes in Studies on the Physiology of Domestic Animals with Special Reference to Hot Climates	FAO	41	19	1	33
10-14 April Ljubljana, Yugoslavia	Symposium on Nuclear Activation Techniques in the Life Sciences		99	23	3	49
17-21 April Vienna	Symposium on Dosimetry Techniques applied to Agriculture, Industry, Biology and Medicine	WHO	122	31	6	58

ANNEX E

STATUS OF FINANCIAL CONTRIBUTIONS TO THE AGENCY ON 30 JUNE 1972

1. Advances to the Working Capital Fund and contributions to the Regular Budget for 1972
(in United States dollars)

Member State	Working Capital Fund			Regular Budget for 1972			
	Assessed	Paid	Outstanding	Assessed	Credits	Paid	Outstanding
Afghanistan	680	680	-	5 934	-	-	5 934
Albania	680	680	-	5 934	-	-	5 934
Algeria	1 360	1 360	-	12 056	170	11 886	-
Argentina	13 090	13 090	-	115 541	1 190	114 351	-
Australia	22 780	22 780	-	207 536	680	103 428	103 428
Austria	8 500	8 500	-	77 439	340	77 099	-
Belgium	16 320	16 320	-	148 682	680	148 002	-
Bolivia	680	680	-	5 934	-	-	5 934
Brazil	12 410	12 410	-	109 796	-	-	109 796
Bulgaria	2 720	2 720	-	23 734	-	-	23 734
Burma	850	850	-	7 417	-	-	7 417
Byelorussian Soviet Socialist Republic	7 650	7 650	-	69 694	170	34 762	34 762
Cameroon	680	680	-	5 934	-	5 934	-
Canada	47 600	47 600	-	433 656	-	433 656	-
Ceylon	850	850	-	7 417	-	-	7 417
Chile	3 060	3 060	-	27 267	-	-	27 267
China	61 880	61 540[a/]	340	539 580	-	-	539 580
Colombia	2 890	2 890	-	25 406	170	-	25 236
Costa Rica	680	680	-	5 934	-	-	5 934
Cuba	2 550	2 550	-	22 627	-	3 569	19 058
Cyprus	680	680	-	5 934	-	5 934	-
Czechoslovak Socialist Republic	13 940	13 940	-	126 999	170	-	126 829
Denmark	9 520	9 520	-	86 731	-	86 731	-
Dominican Republic	680	680	-	5 934	-	-	5 934
Ecuador	680	680	-	5 934	-	-	5 934
Egypt, Arab Republic of	2 720	2 720	-	24 111	-	1 569	22 542
El Salvador	680	680	-	5 934	-	-	5 934
Ethiopia	680	680	-	5 934	-	-	5 934
Finland	6 970	6 970	-	63 500	510	-	62 990
France	92 820	92 820	-	845 629	-	832 015	13 614
Gabon	680	680	-	5 934	1 159	-	4 775
Germany, Federal Republic of	105 060	105 060	-	957 140	2 890	477 125	477 125
Ghana	1 020	1 020	-	9 089	170	8 919	-
Greece	4 420	4 420	-	38 568	-	38 568	-
Guatemala	850	850	-	7 417	-	-	7 417
Haiti	680	680	-	5 934	-	-	5 934
Holy See	680	680	-	6 196	-	6 196	-
Hungary	7 480	7 480	-	68 145	-	-	68 145
Iceland	680	680	-	6 196	-	6 196	-
India	23 970	23 970	-	212 175	2 720	207 230	2 225
Indonesia	4 250	4 250	-	38 215	-	1 020	37 195
Iran	3 400	3 400	-	29 668	-	-	29 668
Iraq	1 020	1 020	-	8 900	-	8 900	-
Ireland	2 380	2 380	-	21 682	170	21 512	-
Israel	3 060	3 060	-	27 877	-	27 877	-
Italy	54 740	49 810	4 930	498 704	-	-	498 704
Ivory Coast	680	680	-	5 934	-	5 934	-
Jamaica	680	680	-	6 123	170	5 953	-
Japan	83 470	58 140	25 330	760 447	-	-	760 447
Jordan	680	680	-	5 934	-	-	5 934
Kenya	680	680	-	5 934	-	5 934	-
Khmer Republic	680	680	-	5 934	-	-	5 934
Korea, Republic of	1 700	1 700	-	15 022	170	14 852	-
Kuwait	1 190	1 190	-	10 841	-	10 841	-
Lebanon	850	850	-	7 417	-	7 417	-

Member State	Working Capital Fund			Regular Budget for 1972			
	Assessed	Paid	Outstanding	Assessed	Credits	Paid	Outstanding
Liberia	680	680	-	5 934	-	-	5 934
Libyan Arab Republic	1 020	1 020	-	9 292	-	-	9 292
Liechtenstein	680	680	-	6 196	-	-	6 196
Luxembourg	850	850	-	7 743	-	7 743	-
Madagascar	680	680	-	5 934	-	778	5 156
Malaysia	1 530	1 530	-	13 539	170	13 369	-
Mali	680	680	-	5 934	-	-	5 934
Mexico	13 600	13 600	-	118 483	-	118 483	-
Monaco	680	680	-	6 196	-	6 196	-
Morocco	1 360	1 360	-	12 056	170	11 886	-
Netherlands	18 190	18 190	-	165 718	-	165 718	-
New Zealand	4 930	4 930	-	44 914	680	-	44 234
Niger	680	680	-	5 934	-	5 934	-
Nigeria	1 870	1 870	-	16 694	-	784	15 910
Norway	6 630	6 630	-	60 402	-	-	60 402
Pakistan	5 270	5 270	-	46 363	340	-	46 023
Panama	680	680	-	5 934	-	-	5 934
Paraguay	680	-	680	5 934	-	-	5 934
Peru	1 530	1 530	-	13 351	-	-	13 351
Philippines	4 760	4 760	-	42 100	510	-	41 590
Poland	21 760	21 760	-	190 817	850	94 980	94 987
Portugal	2 550	2 550	-	22 062	-	22 062	-
Romania	5 610	5 610	-	48 953	-	24 972	23 981
Saudi Arabia	1 020	1 020	-	8 712	-	8 712	-
Senegal	680	680	-	5 934	-	514	5 420
Sierra Leone	680	680	-	5 934	-	-	5 934
Singapore	850	850	-	7 417	-	7 417	-
South Africa	8 330	8 330	-	72 310	-	72 310	-
Spain	16 150	14 110	2 040	138 660	-	-	138 660
Sudan	680	680	-	6 123	-	170	5 953
Sweden	19 380	19 380	-	176 559	-	176 559	-
Switzerland	12 920	12 920	-	117 706	340	117 366	-
Syrian Arab Republic	680	680	-	5 934	-	-	5 934
Thailand	2 040	2 040	-	17 801	-	17 801	-
Tunisia	680	680	-	5 934	199	5 735	-
Turkey	5 440	5 440	-	47 469	-	47 469	-
Uganda	680	680	-	5 934	-	-	5 934
Ukrainian Soviet Socialist Republic	28 900	28 900	-	263 291	850	131 220	131 221
Union of Soviet Socialist Republics	219 130	219 130	-	1 996 366	5 780	995 293	995 293
United Kingdom of Great Britain and Northern Ireland	91 120	91 120	-	830 141	10 710	819 431	-
United States of America	535 840	535 840	-	4 881 726	-	-	4 881 726
Uruguay	1 020	1 020	-	9 277	-	-	9 277
Venezuela	6 290	6 290	-	55 640	-	-	55 640
Viet-Nam	1 020	1 020	-	8 900	-	8 900	-
Yugoslavia	5 950	5 950	-	52 108	170	38 372	13 566
Zaire, Republic of	680	680	-	6 123	-	-	6 123
Zambia	680	680	-	5 934	-	-	5 934
TOTAL	1 700 000	1 666 680	33 320	15 392 000	32 298	5 633 584	9 726 118

a/ The payment was made prior to 9 December 1971 by the authority representing China in the Agency at that time.

2. Outstanding contributions to the Regular Budget for the years 1958-1971

	1958-1961	1962	1963	1964	1965	1966[a]	1967	1968	1969	1970	1971	Total
Afghanistan	-	-	-	3 343	3 857	4 333	4 587	5 082	4 155	4 741	5 221	35 319
Bolivia	-	-	-	-	-	-	1 802	4 040	4 355	4 741	5 221	20 159
Brazil	-	-	-	-	-	-	-	-	-	89 656	105 721	195 377
Ceylon	-	-	-	-	-	-	-	-	-	841	6 248	7 089
Chile	-	-	-	-	-	-	-	-	-	19 811	27 409	47 220
China	-	-	-	-	-	-	-	-	-	414 872	472 482	887 354
Costa Rica	-	-	-	-	-	-	-	-	-	-	2 086	2 086
Dominican Republic	-	3 015	3 561	3 610	3 857	3 467	3 670	4 065	4 355	4 741	5 221	39 562
Ecuador	-	-	-	-	-	-	-	-	3 435	4 741	5 221	13 397
El Salvador	-	-	-	-	-	-	-	-	4 124	4 741	5 221	14 086
Ethiopia	-	-	-	-	-	-	-	-	-	-	4 679	4 679
Guatemala	-	-	-	-	-	-	-	-	4 514	5 926	6 526	16 966
Haiti	6 825[b]	2 652	2 849	2 888	3 085	3 467	3 670	4 065	4 355	4 741	5 221	43 818
Honduras[c]	-	-	-	2 020	3 085	3 467	3 670	-	-	-	-	12 242
Hungary	-	-	-	-	-	-	-	-	-	1 820	61 344	63 164
Jordan	-	-	-	-	-	-	-	-	-	-	4 928	4 928
Liberia	-	-	-	-	-	21	-	4 040	4 283	4 741	5 221	18 306
Libyan Arab Republic	-	-	-	-	-	-	-	-	-	-	340	340
Mali	-	-	-	-	-	-	2 322	4 065	4 355	4 741	5 221	20 704
Nicaragua[d]	-	-	-	-	-	-	-	-	-	3 707	-	3 707
Panama	-	-	-	-	-	-	-	-	-	-	487	487
Paraguay	3 530[e]	2 652	2 849	2 888	3 085	3 467	3 670	4 065	4 355	4 741	5 341	45 643
Peru	-	-	-	-	-	-	-	-	-	1 664	11 747	13 411
Sierra Leone	-	-	-	-	-	-	-	-	-	-	2 476	2 476
Uganda	-	-	-	-	-	-	-	-	-	4 507	5 221	9 728
United States of America	-	-	-	-	-	-	-	-	-	-	1 190	1 190
Uruguay	-	-	-	-	-	-	-	-	-	-	10 102	10 102
Venezuela	-	-	-	-	-	-	-	-	-	45 283	53 513	98 796
Zaire, Republic of	-	-	-	-	-	-	-	-	-	-	5 897	5 897
Zambia	-	-	-	-	-	-	-	-	3 717	4 714	5 221	13 679
Total outstanding	15 355	8 319	9 259	14 749	16 969	18 222	23 391	29 422	46 003	635 497	834 726	1 651 912
Total paid	21 406 075	6 631 760	7 146 004	7 215 525	7 715 313	8 659 337	9 161 619	10 142 208	10 865 450	11 235 283	12 511 933	112 690 507
Total assessed	21 421 430	6 640 079	7 155 263	7 230 274	7 732 282	8 677 559	9 185 010	10 171 630	10 911 453	11 870 780	13 346 659	114 342 419
Percentage of assessment	99.92	99.87	99.87	99.80	99.78	99.79	99.75	99.71	99.57	94.65	93.74	98.55

a/ Includes supplementary assessment.
b/ Payable to the Regular Budgets as follows: $2021 for 1959; $2337 for 1960; $2467 for 1961.
c/ Withdrew from membership on 19 June 1967.
d/ Withdrew from membership on 14 December 1970.
e/ Payable to the Regular Budgets as follows: $1636 for 1958; $2090 for 1959; $2337 for 1960 and $2467 for 1961.

3. Voluntary contributions to the General Fund for 1971 and 1972

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

Member State	1971			1972		
	Pledged	Paid	Outstanding	Pledged	Paid	Outstanding
Afghanistan	-	-	-	- [b]	-	-
Albania	800 [a]	800	-	800 [b]	-	800
Algeria	-	-	-	2 400	2 400	-
Argentina	21 000 [a]	12 191	8 809	23 100 [b]	-	23 100
Australia	30 000 [a]	30 000	-	30 000 [b]	30 000	-
Austria	13 000	13 000	-	15 000 [b]	15 000	-
Belgium	12 500 [a]	12 500	-	20 000 [b]	-	20 000
Bolivia	-	-	-	-	-	-
Brazil	30 000	-	30 000	21 900 [b]	-	21 900
Bulgaria	4 000	4 000	-	4 000 [b]	-	4 000
Burma	1 000 [a]	1 000	-	1 000 [b]	-	1 000
Beylorussian Soviet Socialist Republic	-	-	-	-	-	-
Cameroon	1 000	-	1 000	-	-	-
Canada	70 000	70 000	-	70 000 [b]	-	70 000
Ceylon	1 250	1 250	-	1 250 [b]	-	1 250
Chile	1 000 [a]	-	1 000	-	-	-
China	10 000 [ac]	10 000 [c]	-	10 000 [bc]	-	10 000
Colombia	2 500 [a]	2 500	-	-	-	-
Costa Rica	-	-	-	800 [b]	-	800
Cuba	-	-	-	4 500	4 500	-
Cyprus	900 [a]	900	-	1 200 [b]	1 200	-
Czechoslovak Socialist Republic	20 833	20 833	-	20 833 [b]	-	20 833
Denmark	14 000	14 000	-	16 800	16 800	-
Dominican Republic	-	-	-	-	-	-
Ecuador	-	-	-	-	-	-
Egypt, Arab Republic of	11 500	11 500	-	11 500	-	11 500
El Salvador	-	-	-	-	-	-
Ethiopia	-	-	-	-	-	-
Finland	11 000 [a]	11 000	-	12 300 [b]	-	12 300
France	30 571 [a]	30 571	-	30 213 [b]	30 213	-
Gabon	-	-	-	-	-	-
Germany, Federal Republic of	158 750	158 750	-	185 400	92 700	92 700
Ghana	2 000	2 000	-	2 000	2 000	-
Greece	7 800	7 800	-	7 800	7 800	-
Guatemala	500 [a]	500	-	-	-	-
Haiti	-	-	-	-	-	-
Holy See	2 000	2 000	-	3 000 [b]	3 000	-
Hungary	11 800	11 800	-	12 667 [b]	12 667	-
Iceland	1 000	1 000	-	-	-	-
India	40 000	40 000	-	42 500	-	42 500
Indonesia	7 750 [a]	7 750	-	7 500 [b]	-	7 500
Iran	4 600 [a]	4 600	-	5 000 [b]	-	5 000
Iraq	1 500	1 500	-	1 800	1 800	-
Ireland	3 750 [a]	3 750	-	4 200	4 200	-
Israel	3 600 [a]	3 600	-	5 400	5 400	-
Italy	73 250 [a]	73 250	-	80 500 [b]	-	80 500
Ivory Coast	800 [a]	800	-	929 [b]	929	-
Jamaica	-	-	-	-	-	-
Japan	85 500	85 500	-	-	-	-
Jordan	-	-	-	800 [b]	-	800
Kenya	-	-	-	-	-	-
Khmer, Republic	-	-	-	-	-	-
Korea, Republic of	2 750	2 750	-	3 000	3 000	-
Kuwait	1 500	1 500	-	2 100	2 100	-
Lebanon	1 250	1 250	-	1 500	1 500	-
Liberia	-	-	-	-	-	-
Libyan Arab Republic	-	-	-	-	-	-
Liechtenstein	1 000	1 000	-	1 000 [b]	1 000	-
Luxembourg	-	-	-	-	-	-
Madagascar	1 000	1 000	-	1 000	-	1 000

Member State	1971			1972		
	Pledged	Paid	Outstanding	Pledged	Paid	Outstanding
Malaysia	-	-	-	-	-	-
Mali	-	-	-	-	-	-
Mexico	14 090[a]	14 090	-	-	-	-
Monaco	2 000	2 000	-	2 000[b]	2 000	-
Morocco	2 050[a]	2 050	-	1 812[b]	1 812	-
Netherlands	40 000	40 000	-	40 000	40 000	-
New Zealand	6 600[a]	6 600	-	-	-	-
Niger	-	-	-	1 200	1 200	-
Nigeria	3 080[a]	-	3 080	-	-	-
Norway	9 750	9 750	-	11 700	-	11 700
Pakistan	8 250	8 250	-	8 250[b]	8 250	-
Panama	1 000	1 000	-	1 000[b]	1 000	-
Paraguay	-	-	-	-	-	-
Peru	2 250	2 250	-	2 250[b]	1 500	750
Philippines	7 750	7 750	-	8 000[b]	7 809	191
Poland	10 417[a]	10 417	-	11 322[b]	11 322	-
Portugal	3 600	3 600	-	4 500	4 500	-
Romania	8 250	8 250	-	9 900	-	9 900
Saudi Arabia	2 000	2 000	-	2 000	2 000	-
Senegal	-	-	-	-	-	-
Sierra Leone	-	-	-	-	-	-
Singapore	1 000[a]	1 000	-	1 500	1 500	-
South Africa	11 750	11 750	-	14 700	14 700	-
Spain	20 750	20 750	-	28 500	28 500	-
Sudan	-	-	-	-	-	-
Sweden	28 250	28 250	-	34 200	34 200	-
Switzerland	19 500	19 500	-	22 800	22 800	-
Syrian Arab Republic	708[a]	708	-	-	-	-
Thailand	4 000	4 000	-	4 000	4 000	-
Tunisia	-	-	-	-	-	-
Turkey	8 000	8 000	-	8 000[b]	8 000	-
Uganda	-	-	-	-	-	-
Ukranian Soviet Socialist Republic	-	-	-	-	-	-
Union of Soviet Socialist Republics	277 778[a]	277 778	-	277 778[b]	218 712	59 066
United Kingdom of Great Britain and Northern Ireland	150 948	150 948	-	160 800	-	160 800
United States of America	786 250[de]	786 250	-	945 600[de]	55 000	890 600
Uruguay	2 000	-	2 000	1 800[b]	-	1 800
Venezuela	8 700[a]	8 700	-	8 700[b]	8 700	-
Viet-Nam	1 200[a]	1 200	-	1 800[b]	1 800	-
Yugoslavia	9 000	9 000	-	9 000[b]	-	9 000
Zaire, Republic of	1 500	-	1 500	1 200	-	1 200
Zambia	-	-	-	-	-	-
TOTAL	2 151 375	2 103 986	47 389	2 290 004	717 514	1 572 490

a/ Pledge is less than the Member's Regular Budget assessment ratio (GC(XIV)/RES/267) applied to the target of $2.5 million for voluntary contributions set by Resolution GC(XIV)/RES/265, para. 1.

b/ Pledge is less than the Member's base rate of assessment (GC(XV)/RES/284) applied to the target of $3 million of voluntary contributions set by Resolution GC(XV)/RES/281, para. 1.

c/ The entries in respect of 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/ 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 approximately $760 000 for the year 1971 and $604 000 for the year 1972. 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 made in 1971 is provided in the Agency's accounts for last year (GC(XVI)/484, Schedule G).

e/ 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.