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OF THE  
BOARD OF GOVERNORS  
TO THE  
GENERAL CONFERENCE

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## CONTENTS

	<u>Paragraphs</u>	<u>Page</u>
INTRODUCTION	1 - 10	5
PROGRAMMES OF ACTIVITY	11 - 115	9
Technical co-operation	11 - 16	9
Food and agriculture	17 - 29	12
Life sciences	30 - 37	16
Physical sciences	38 - 51	20
Nuclear power and reactors	52 - 73	24
Health safety and waste management	74 - 87	29
Information and technical services	88 - 98	32
Safeguards	99 - 115	35
ADMINISTRATION	116 - 136	46
External relations	116 - 121	46
Personnel	122 - 123	46
Finance	124 - 132	48
Legal matters	133 - 136	51

## ANNEXES

ANNEX A	THE BOARD OF GOVERNORS
ANNEX B	FELLOWSHIPS OFFERED OR PROVIDED FREE OF CHARGE IN 1969
ANNEX C	RESEARCH CONTRACTS
	1. Total value of contracts in 1969
	2. Analysis by subject matter of contracts awarded or renewed in 1969
	3. Analysis by country of contracts awarded or renewed in 1969

ANNEX D                    CONFERENCES, SYMPOSIA AND SEMINARS HELD DURING THE  
PERIOD 1 JULY 1969-30 JUNE 1970

ANNEX E                    STATUS OF FINANCIAL CONTRIBUTIONS TO THE AGENCY ON  
30 JUNE 1970

1.   Advances to the Working Capital Fund and contributions to the  
     Regular Budget for 1970
2.   Outstanding contributions to the Regular Budgets for 1953-1969
3.   Voluntary contributions to the General Fund for 1969 and 1970

List of abbreviations

ACC	Administrative Committee on Co-ordination
Agency	International Atomic Energy Agency
AGR	Advanced gas cooled, graphite moderated reactor
BWR	Boiling light water cooled, light water moderated reactor
ENEA	European Nuclear Energy Agency of the Organisation for Economic Co-operation and Development
EURATOM	European Atomic Energy Community
FAO	Food and Agriculture Organization of the United Nations
HWR	Heavy water moderated reactor
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
IHD	International Hydrological Decade
ILO	International Labour Organisation
INDC	International Nuclear Data Committee
INIS	International Nuclear Information System
IUPAC	International Union of Pure and Applied Chemistry
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
OECD	Organisation for Economic Co-operation and Development
OPANAL	Organization for the Prohibition of Nuclear Weapons in Latin America
PWR	Pressurized light water moderated and cooled reactor
SIDA	Swedish International Development Authority
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

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 NOTE

All sums of money are expressed in United States dollars.



## INTRODUCTION

1. The most important event for the Agency during the period covered by this report was the entry into force on 5 March of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). This will entail a growth in the safeguards responsibilities of the Agency and, in the light of Articles IV and V, NPT should also give new force to international co-operation, through the Agency, as well as directly between the Parties, in promoting the peaceful uses of nuclear energy, particularly in developing countries. The Board has been pleased to note that in 1970 considerably more resources than in any previous year were pledged to the Agency's own programmes for technical assistance. It has thus become possible to recommend for the first time since 1962 an increase in the target for voluntary contributions to the Agency's General Fund.
2. The implications of NPT for the Agency's work were discussed by the Board in February and again at meetings on 1 and 2 April. At these meetings the Board decided to establish a committee to advise it on the Agency's safeguards responsibilities in relation to NPT and in particular on the content of the agreements which will be required in connection with NPT. All Member States were invited to communicate their views on this subject and to be represented at the meetings of the committee if they so desired. The Director General was also requested to submit various reports including an initial report containing his views on the content of the agreements required, the negotiation of which must begin within 180 days of NPT's entry into force. The committee began its meetings on 12 June. The Board will be meeting before 25 August to consider the matter and will inform the General Conference subsequently of developments in this regard. By 30 June 1970 certain Member States [1] had expressed their readiness, in conformity with the obligations they have assumed under Article III of NPT, to enter into negotiations of safeguards agreements with the Agency.
3. The development and improvement of safeguards methods and techniques has been given much attention by the Secretariat and Member States. The reports of the various groups of consultants mentioned in last year's report [2] have provided a valuable basis for systems analysis, research and development programmes, and for studies of safeguards agreements. The consultants' recommendations have been further studied and refined by a number of panels on the special topics.
4. By 30 June, 17 Latin American countries had ratified the Treaty for the Prohibition of Nuclear Weapons in Latin America (the Tlatelolco Treaty). Of these all but one had waived the conditions preventing the immediate entry into force of the Treaty; it was therefore in force between 16 States at that date. Under Article 13 of the Treaty these States are required to conclude comprehensive safeguards agreements with the Agency. At its first session OPANAL adopted a resolution on 8 September 1969, in which it recommended that its Member States should initiate negotiations with the Agency as soon as possible, and invited the Director General of the Agency to explore the possibility of preparing a model draft safeguards agreement which could serve as a basis for these negotiations. This question is being considered in connection with the closely related one of safeguards agreements to be concluded pursuant to NPT.
5. The Board has given close attention to Resolution GC(XIII)/RES/261, which the General Conference adopted in September 1969, concerning the review of Article VI of the Statute. The Ad Hoc Committee of the Whole held one meeting last December, two meetings in February and a further meeting early in June. Over this period it had before it a total of eight suggestions for changing the Board's composition, several of which were modified versions of suggestions first made last year. Subsequently, three formal proposals for amendment of the Statute were communicated to the Director General by 12, seven and one Member State respectively. The Board began consideration of these amendments at its meeting in June, deciding to meet again on 7 July with a view to the formulation of observa-

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[1] Bulgaria, the Czechoslovak Socialist Republic, Hungary and Poland.

[2] GC(XIII)/404, para. 117.

tions upon each of them, as required under Article XVIII. C(i). Before the end of June two more such proposals — one by two Members and the other by one Member — were received by the Director General; in addition the 12 Member proposal had been amended and 18 Members were by then sponsoring it. It is to be foreseen that in July the Board will give its attention to all five proposals.

6. The General Conference's attention is also drawn to two special reports to the Secretary-General of the United Nations prepared in response to General Assembly Resolution 2605 (XXIV). The first is a further report on the action taken by the Agency in connection with some of the recommendations made by the Conference of Non-Nuclear-Weapon States in September 1968 [3]. The second special report [4] informs the General Assembly of the progress made in the Agency's further studies and activities relating to nuclear explosions for peaceful purposes under appropriate international control.

7. In response to General Conference Resolution GC(XIII)/RES/256 the Director General submitted to the Board in June the first part of a study on the financing of nuclear projects. The Board's report to the Conference on its review of this material is contained in document GC(XIV)/436.

8. Estimates of the installed nuclear capacity throughout the world by 1980 have been slightly increased since last year's report [5] to 320-355 000 MW, of which it is expected that about 7-8% will be in developing countries. The Agency is continuing to encourage progress towards cheaper small- or medium-sized nuclear power plants of interest to developing countries, and a co-ordinated research programme on this subject has been launched with the participation initially of Belgium, the Federal Republic of Germany, Sweden and the Union of Soviet Socialist Republics.

9. INIS started its output in the first days of May 1970 using material reported to it up to 1 April 1970. By 30 June, 35 countries and four organizations had agreed to participate in the project thus assuring it of at least 90% coverage of the services of the world's publications on nuclear subjects.

10. WHO has agreed to co-sponsor a considerable number of the Agency's recommendations and standards for nuclear safety, such as the Agency's basic safety standards for radiation protection, the safe handling of radioisotopes and the management of radioactive wastes produced by radioisotope users. It is expected that WHO's co-sponsorship of such recommendations will become a matter of course. This is a particularly welcome development at a time when public concern about the problems of pollution and environmental effects is manifest in many parts of the world. In the light of this concern the Agency is holding a symposium, in addition to its already approved programme, on environmental aspects of nuclear power stations, at United Nations Headquarters in New York from 10 to 14 August.

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[3] GC(XIV)/INF/120.

[4] GC(XIV)/INF/121.

[5] GC(XIII)/404, para. 64.



## PROGRAMMES OF ACTIVITY

## TECHNICAL CO-OPERATION

General

11. In 1969 some 3.7 million dollars was available for technical assistance and training compared to 3.5 million dollars in 1968. The breakdown is given in Table 1 below:

Table 1

## Technical co-operation resources

	<u>1968</u>	<u>1969</u>
	(in thousands of dollars)	
Regular programme	1348	1586
UNDP(TA)	1134	748
UNDP(SF)	415	792
Assistance in kind (estimated value)	614	627
	<u>3511</u>	<u>3753</u>

Experts and equipment

12. Until 1969 cash resources of the regular programme had been equally shared between experts and equipment on the one hand and training on the other. However, since most contributions in kind are in the form of "Type II" fellowships, it was decided in 1970 to divide cash resources in the ratio 40 (training) : 60 (experts and equipment). Hence, as is shown in Table 2 below, the value of approved requests for experts and equipment increased from \$977 000 in 1969 to \$1 250 000 in 1970. The percentage of aid granted in this form rose from 26.4% to 36.8% of that requested. The nominal value of the programme is thus about 25% more than it was in the years 1967 to 1969 but much of this increase has been absorbed by higher salaries for experts.

Table 2

## Experts and equipment

Year	Value of requests received (in thousands of dollars)	Value of assistance approved (in thousands of dollars)	Percentage of requests met
1966	3 000	901.6	30.0
1967	2 600	975.0	37.5
1968	3 600	977.0	27.1
1969	3 700	977.0	26.4
1970	3 400	1 250.0	36.8

13. Other developments in the regular programme include:

- (a) During the period 1966-1970, the share of resources allocated to equipment rose from 18.5% in 1966 to 23.7% in 1969 and to 25% in 1970;

- (b) The number of Member States receiving experts or equipment, or both, rose to 46 in 1969 and to 52 in 1970; and
- (c) In the 1970 programme 44 requests were found to be technically sound but could not be met because of lack of funds (as compared to 47 in 1969). As is customary, these request were brought to the attention of technically advanced Member States.

### Training

14. Trends in fellowship awards over the period 1966-1970 are shown in the following table:

Table 3

Distribution of fellowship awards

Type of fellowship	1966	1967	1968	1969	1970 <sup>a/</sup>
"Type I"	82	113	121	118	114
"Type II"	137	138	148	146	155
UNDP (TA)	64	18	46	30	23
TOTAL	283	269	315	294	292

<sup>a/</sup> Whereas the 1966-1969 awards data reflect the totals as at 31 December of those years, the 1970 awards data indicate the status as at 30 June 1970, by which time most awards for this year will have been made. Further, the five fellowships awarded in 1970 for study at the International Centre for Theoretical Physics at Trieste have not been included in the 1970 awards data, as, beginning in 1970, fellowship training at the Trieste Centre is no longer a "technical assistance" activity from a funding standpoint.

15. A list of the fellowships offered or provided as assistance in kind (Type II) by Member States in 1969 is given in Annex B.

16. Table 4 below provides an analysis of the 12 training courses and two study tours (seminars) that the Agency arranged in 14 countries from mid-1969 to mid-1970. Three of these training courses were jointly sponsored by FAO; one was part of the Agency's UNDP(SF) regional project in Central America and another was financed out of funds provided by SIDA.

Table 4  
Regional and inter-regional short-term training projects

Title	Place and dates	Number of applications received <sup>a/</sup>	Participation <sup>b/</sup> (1) + (2) + (3)			Lecturers <sup>c/</sup>	
						Outside	Agency's staff
International advanced training course on food irradiation technology and techniques <sup>d/</sup>	Cambridge, Massachusetts, United States of America 18 June to 25 July 1969	34	18	-	-	-	1
Study tour (seminar) on waste management techniques and programmes <sup>e/</sup>	Czechoslovak Socialist Republic, Poland and the Union of Soviet Socialist Republics 8 July to 20 August 1969	28	14	-	-	-	2
Inter-regional training course on planning for the handling of radiation accidents <sup>f/</sup>	Teheran 1 to 13 September 1969	19	14	-	9	6 <sup>g/</sup>	3
International survey course on economic and technical aspects of nuclear power	Vienna 1 to 12 September 1969	81	31	33	-	20 <sup>g/</sup>	11
Regional training course in uranium prospection <sup>f/</sup>	Buenos Aires and Salta, Argentina; 8 September to 31 October 1969	16	13	1	2	1	1
International training course on the use of isotopes and radiation in entomology <sup>h/</sup>	Gainesville, Florida, United States of America 6 October to 28 November 1969	45	15	-	-	2	1
Regional training course on application of isotope techniques in hydrology <sup>e/</sup>	São Paulo, Brazil 6 October to 21 November 1969	14	13	-	10	4 <sup>i/</sup>	3
Inter-regional training course on the use of isotopes and radiation equipment in soil and plant nutrition studies <sup>i/</sup>	Teheran 3 November to 19 December 1969	16	14	1	10	3	3
Inter-regional training course on medical applications of radioisotopes <sup>e/</sup>	Khartoum 17 January to 11 February 1970	16	10	-	6	8 <sup>j/</sup>	4
Inter-regional training course on maintenance and repair of nuclear electronic equipment <sup>h/</sup>	Turn, Italy 16 March to 12 June 1970	39	24	-	-	10	1
Regional training course on the use of isotopes and radiation in entomology <sup>h/</sup>	Turrialba, Costa Rica 20 April to 29 May 1970	19	17	-	3	14 <sup>m/</sup>	2
Inter-regional training course on the use of isotopes and radiation in animal science <sup>h/</sup>	Zemum, Yugoslavia 4 May to 12 June 1970	34	14	-	1	8	3
Study tour (seminar) on in vivo radioisotope measurement techniques in medicine <sup>e/</sup>	Czechoslovak Socialist Republic, Denmark, Sweden and the Soviet Union 11 May to 27 June 1970	32	15	-	-	-	2
Inter-regional training course on nuclear techniques in the mining industry <sup>e/</sup>	Cracow, Poland 8 June to 7 July 1970	15	15	-	6	2	1

- <sup>a/</sup> Applications are normally reviewed in respect of non-host country candidates only, that is, those included under participation groups (1) and (2) shown in the next column.
- <sup>b/</sup> (1) Denotes the number of award holders whose cost of participation was met out of project funds;  
(2) Denotes the number of participants who attended at the expense of the Government, another organization or programme; and  
(3) Denotes the number of local participants; no stipend or travel costs are payable out of project funds in respect of their attendance.
- <sup>c/</sup> Does not include lecturers provided cost-free by the host country.
- <sup>d/</sup> Project costs were shared between the Agency, FAO and the host country.
- <sup>e/</sup> Financed under UNDP(TA).
- <sup>f/</sup> Includes one lecturer provided by WHO.
- <sup>g/</sup> Includes 12 lecturers provided cost-free, as follows: one each by Belgium, France, the Federal Republic of Germany and Italy; three by the United Kingdom and five by the United States.
- <sup>h/</sup> Project costs were shared between the Agency and FAO.
- <sup>i/</sup> Includes one lecturer provided by UNESCO.
- <sup>j/</sup> An FAO project financed under UNDP(TA).
- <sup>k/</sup> Project costs were shared between the Agency and UNDP(TA).
- <sup>l/</sup> Financed under UNDP(SF).
- <sup>m/</sup> Includes five lecturers provided partly cost-free.
- <sup>n/</sup> Financed out of funds provided by SIDA.

## FOOD AND AGRICULTURE

General

17. The work relating to nuclear applications in food and agriculture continues to centre on co-ordinated research programmes, summarized in Table 5 below.

Table 5

## Co-ordinated research programmes in nuclear applications in food and agriculture

Research programme	Countries in which co-ordinated research programmes are being carried out
1. Tree crop fertilization	Ceylon, China, Colombia, Ghana, Ivory Coast <sup>a/</sup> , Japan <sup>a/</sup> , Kenya, Malaysia <sup>a/</sup> , Philippines, Spain, Uganda
2. Water use efficiency	Belgium, Brazil, Federal Republic of Germany <sup>a/</sup> , Iran, Iraq, Israel, Kenya, Lebanon, Pakistan, Sudan, United Arab Republic
3. Wheat fertilization	Brazil, Greece, Hungary, India <sup>a/</sup> , Italy <sup>a/</sup> , Lebanon, Mexico, Morocco, Peru, Pakistan, Romania, Turkey, United Arab Republic
4. Rice production	Ceylon, China, India, Indonesia, Republic of Korea, Pakistan, Thailand, Viet-Nam
5. Physico-chemical relationship of soils and plants	Australia <sup>a/</sup> , Belgium, Burma, Canada <sup>a/</sup> , Denmark <sup>a/</sup> , Ghana, Hungary (1+1 <sup>a/</sup> ), Netherlands <sup>a/</sup> , Pakistan (2), Madagascar, United States <sup>a/</sup>
6. Rice mutation breeding	Brazil, Ceylon, China, India, Japan <sup>a/</sup> , Republic of Korea, Pakistan (2), Philippines, Thailand, Viet-Nam
7. Production and use of induced mutations in plant breeding	Argentina, Australia, Denmark <sup>a/</sup> , France <sup>a/</sup> , Federal Republic of Germany <sup>a/</sup> , India <sup>a/</sup> , Italy <sup>a/</sup> , Japan <sup>a/</sup> , Sweden (2 <sup>a/</sup> ), Soviet Union <sup>a/</sup> , United States (2 <sup>a/</sup> ), Yugoslavia <sup>a/</sup>
8. Neutron seed irradiation	Austria <sup>a/</sup> , Bulgaria, China, France <sup>a/</sup> , Federal Republic of Germany <sup>a/</sup> , India, Italy <sup>a/</sup> , Netherlands <sup>a/</sup> , Philippines, Puerto Rico <sup>a/</sup> , Thailand, United Kingdom <sup>a/</sup> , United States (3 <sup>a/</sup> ), Venezuela
9. Plant protein improvement	China, India, Japan, Republic of Korea, Pakistan, Philippines, Thailand
10. Trace element metabolism and disease in livestock	Argentina, Austria <sup>a/</sup> , Cuba, Denmark <sup>a/</sup> , Federal Republic of Germany (2 <sup>a/</sup> ), Netherlands <sup>a/</sup> , United Kingdom (2 <sup>a/</sup> ), United States (3 <sup>a/</sup> ), Yugoslavia

Research programme	Countries in which co-ordinated research programmes are being carried out
11. Parasitic diseases in domestic animals	Czechoslovak Socialist Republic <sup>a/</sup> , Denmark <sup>a/</sup> , Hungary, Kenya (2), Israel <sup>a/</sup> , Italy <sup>a/</sup> , United Kingdom <sup>a/</sup> , United States <sup>a/</sup> , Yugoslavia <sup>a/</sup>
12. Fruit fly eradication or control by the sterile-male technique	Federal Republic of Germany <sup>a/</sup> , Netherlands, Portugal (1+1 <sup>a/</sup> ), Spain, Switzerland <sup>a/</sup>
13. Control of animal insect pests by the sterile-male technique	Belgium <sup>a/</sup> , El Salvador, Federal Republic of Germany <sup>a/</sup> , Kenya, Portugal, United Kingdom <sup>a/</sup>
14. Rice insect control and eradication	China (2), Republic of Korea, Pakistan (2), Thailand (2)
15. Ecology and behaviour of the <u>Heliothis</u> complex as related to the sterile-male technique	Argentina, El Salvador, Mexico, United States (3 <sup>a/</sup> )
16. Control of insect populations by the sterile-male technique	Austria <sup>a/</sup> , Netherlands, Yugoslavia
17. Microbiological aspects of food preservation by irradiation	Australia <sup>a/</sup> , Federal Republic of Germany <sup>a/</sup> , Hungary <sup>a/</sup> , Japan <sup>a/</sup> , Netherlands, Thailand, United States <sup>a/</sup>
18. Tissue physiology in food preservation by irradiation	Federal Republic of Germany <sup>a/</sup> , Israel, Italy <sup>a/</sup> , Japan, Philippines
19. Preservation of fishery products by irradiation	Belgium, Iceland, Republic of Korea, Philippines, Spain (2)
20. General food irradiation	Denmark <sup>a/</sup> , Republic of Korea, Netherlands, Pakistan, Philippines
21. Residues and pollution	Finland, Yugoslavia

<sup>a/</sup> These contracts are "cost-free research agreements".

#### Soil fertility, irrigation and crop production (Programmes 1-5)

18. The aim of the first programme - Tree crop fertilization - has been achieved, namely to find out which parts of the tree root system absorb most fertilizer by using phosphorus as a tracer. The second programme - Water use efficiency - which will conclude at the end of 1970, has continued to demonstrate the effectiveness of the neutron moisture meter in determining the amounts of irrigation water that should be used and at what intervals to irrigate - in short the best use of scarce water. The results of the third programme - Wheat fertilization - which started in 1968 have been fully computerized, so as to enable rapid evaluation of the large amount of data obtained from each of the 13 projects. Programme 4 - Rice production - was started in late 1969. The aims of the programme are those recommended by a study group that met at Bangkok early in 1969. Programme 5 - Physico-chemical relationship of soils in plants - provides basic data needed for the full interpretation of the first four programmes.

19. During the reporting period, the Agency also held several research co-ordination meetings, and a seven-weeks training course [6] on topics related to soil fertility and irri-  
[6] See Table 4 above.

gation. The Agency's Laboratory at Seibersdorf continued to provide isotopically labelled fertilizers for the various programmes, and to carry out nitrogen-15 assays of plant samples from the field experiments.

Plant breeding and genetics (Programmes 6-9)

20. Programme 6 - Rice mutation breeding - completed its fifth year, and the results were reviewed at a meeting in New Delhi in September 1969, whereas programme 7 - Production and use of induced mutations in plant breeding - will complete its fifth year in 1970 and its achievements will be reviewed at a meeting in Castelar, Argentina. Programme 8 - Neutron seed irradiation - helps developing countries to make a better use of research reactors by installing relatively simple neutron irradiation facilities. The main objective of the ninth programme is to improve the quantity and the quality of seed protein in major food crops. This subject was discussed at an Agency/FAO symposium at Vienna in June 1970 on the improvement of plant protein resources by the application of nuclear techniques.

21. The present status of mutation breeding was reviewed at the Agency/FAO symposium on the nature, induction and the utilization of mutation in plants, in Pullman, Washington, United States, in July 1969. One of the reports showed that at least 77 new varieties of agricultural and horticultural crops have been developed so far by utilizing induced mutations.

Animal production and health (Programmes 10 and 11)

22. The aims of programmes 10 and 11 were described in last year's report [7]. Results from programme 11 suggest that radiation attenuated vaccine can be used against certain protozoal parasites (e.g. Trypanosomes) as well as against helminthic parasites (parasitic worms). The growing interest in using non-protein nitrogen (e.g. urea) as an animal feed - and thus indirectly as a protein producer - has shown that there is an expanding opportunity for using isotopes, particularly nitrogen-15, on this topic.

Insect eradication and pest control (Programmes 12-16)

23. The purposes of programmes 12-16 are largely self-explanatory and involve co-ordinated research on the use of the technique in relation to specific insects, on the behaviour and ecology of insect genera, etc. Programme 13, for instance - Control of animal insect pests by the sterile-male technique - concentrates mainly on the tsetse fly and embraces studies of the radiation sterilization behaviour of this insect and of methods and problems of raising it in captivity.

24. Conclusive results have been obtained in the UNDP(SF) project in Central America on the use of the radiation induced sterile-male technique in controlling the Mediterranean fruit fly. Sterilized Mediterranean fruit flies were released in an area of 48 km<sup>2</sup>, isolated by a 2-km-wide band in which insecticides were used to prevent reinfestation. Approximately 11 million sterile flies were released four times a week until more than a billion had been released. The infestation of fruit in the "release area" was 90-98% lower than in control areas where the sterile-male technique had not been used.

25. Similar but much smaller experiments are producing equally encouraging results on the island of Procida in Italy and in Murcia in Spain. In Procida, clear indications of commercial control were obtained after the release of 15 million sterile flies. In Murcia, the release of 32 million sterile flies brought down fruit infestation to less than 10% compared with 90-100% in untreated control areas.

26. The Seibersdorf Laboratory provided support for the experiments in Central America, Procida and Murcia, as well as training in mass-rearing techniques, and has continued to carry out radiation sterilization studies on the tsetse fly, codling moth and Mediterranean fruit fly. Good progress has been made in rearing the tsetse fly on artificial membrane

[7] GC(XIII)/404, para. 38.

instead of animal hosts. Methods for rearing the Mediterranean fruit fly and the olive fly have been partially mechanized or otherwise improved.

#### Pesticide residues and pollution

27. Growing public concern about the effects of chemical pesticides has stimulated interest in the use of isotopic tracer, and radioactivation techniques in the study of pesticide residues. A programme drawn up by two earlier panels will be carried out in co-operation with FAO, WHO and IUPAC which have shown much interest in the use of these techniques for work in their own fields of interest [8]. The Agency and FAO are also continuing to collect radioactive fall-out data for UNSCEAR.

#### Food preservation (Programmes 17-20)

28. A growing number of irradiated food products is obtaining clearance by public health authorities in various countries. The Agency has continued to collect and exchange information about the legislation that Member States are adopting on this subject as well as on wholesomeness data. At a meeting, at OECD Headquarters in Paris in April 1970, several Governments agreed to launch a new international programme on food irradiation under joint Agency/ENEA auspices. The programme, which will operate largely by the award of research contracts to co-operating laboratories, will give first priority to wholesomeness testing of potatoes, wheat and wheat products, with a view to securing confirmation of the provisional clearance recommended for these irradiated products by a joint Agency/FAO/WHO Expert Committee in April 1969. This clearance will be reviewed in 1974 and additional data must be provided by that time.

29. Under programme 19 - Preservation of fishery products by irradiation - an Agency/FAO panel in December 1969 reviewed the present status of irradiation preservation of foods of marine origin. In May 1970 a panel reviewed programme 17 and recommended that this should concentrate on the control of different pathogenic bacteria and fungi in food and feed products. An international training course on food irradiation technology and techniques was held at Massachusetts Institute of Technology, Cambridge, United States in July, 1969; details of participation are given in Table 4 above. A training manual on food irradiation technology has been prepared by the Secretariat.

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[8] See also last year's report, document GC(XIII)/404, para. 34(b).

## LIFE SCIENCES

Radiation biology

30. The current research support programme on radiation biology is summarized in Table 6 below.

Table 6

## Distribution of research contracts and agreements on radiation biology

Research programme	Countries in which research is conducted with Agency support
Fundamental studies on the mechanisms of radiosensitivity and repair	Algeria, Bulgaria, Chile, China, Czechoslovak Socialist Republic, Ecuador, Greece, Pakistan, Poland, Romania, Uruguay
Radiation haematology, immunology and pathophysiology	Hungary (2) <sup>a/ b/</sup> , Netherlands <sup>a/ b/</sup> , Romania (2), Turkey, Switzerland
Radiation microbiology and genetics	Austria <sup>b/ c/</sup> , France <sup>b/ c/</sup> , Greece <sup>c/</sup> , India (2) <sup>c/</sup> , Israel <sup>b/ c/</sup> , Republic of Korea, Nigeria <sup>c/</sup> , Pakistan <sup>c/</sup>
Biological effects of incorporated radioactive nuclides (effects of transmutation)	Czechoslovak Socialist Republic, France, Federal Republic of Germany
Modification of radiosensitivity by physical, chemical and biological means	Iran, Romania, Sweden, Turkey
Radiosterilization of pharmaceuticals and biomedical products	Austria <sup>d/</sup> , Denmark <sup>d/</sup> , India <sup>d/</sup> , Italy <sup>d/</sup> , Malaysia <sup>b/ d/</sup> , Thailand <sup>d/</sup> , Turkey <sup>d/</sup> , Yugoslavia <sup>d/</sup>
Attenuation of parasite organisms by radiation for production of vaccines	Belgium, Ethiopia, Malaysia
Improvement of biosphere resources by nuclear techniques	Austria <sup>b/ e/</sup> , India <sup>b/ e/</sup> , United Kingdom <sup>b/ e/</sup>

<sup>a/</sup> Part of co-ordinated research programme on radiation haematology.

<sup>b/</sup> Cost-free research agreement.

<sup>c/</sup> Part of a co-ordinated research programme on radiation microbiology.

<sup>d/</sup> Part of a co-ordinated research programme on radiation sterilization of biomedical products and biological tissues.

<sup>e/</sup> Part of a co-ordinated research programme on the improvement of biosphere resources.

31. In June 1970 the Agency and WHO jointly held a scientific meeting in Paris on biochemical indicators of radiation injury in man. The meeting reviewed recent research on early biochemical and metabolic changes in irradiated organisms that could be used as indicators of radiation injury, in prognosis and in evaluating the effectiveness of therapeutic measures.

Medical applications

32. The general direction of the programme was described in last year's report [9]. Research support programmes are summarized in Table 7 below.



Table 7

## Distribution of research contracts on radioisotope applications in medicine

Research programme	Countries in which research is conducted with Agency support
Anaemia	Cuba, Greece, Pakistan, South Africa, Turkey, United Arab Republic
Goitre	Bolivia, Japan, Turkey, United Arab Republic
Malnutrition	Iran <sup>a/</sup> , Israel <sup>a/b/</sup> , Philippines <sup>a/</sup> , United Arab Republic <sup>a/</sup>
Whole-body counting techniques and their applications, especially in relation to problems of nutrition and public health	Brazil, Romania
Radioisotope techniques and their application in studies of iron metabolism	Chile, India <sup>c/</sup> , Lebanon <sup>c/</sup> , Mexico <sup>c/</sup> , Pakistan, Thailand, United States <sup>c/d/</sup>
Radioactivation techniques and their applications in studies of trace elements and mineral metabolism in man	Greece <sup>e/</sup> , Italy <sup>e/</sup> , United Kingdom <sup>e/</sup>
In vitro assay techniques, such as saturation analysis and radioimmunoassay techniques, and their applications	Argentina (2), Brazil, Bulgaria, Chile (2), Ecuador (2), Republic of Korea, Nigeria (3), Uganda
Radioisotope techniques and their applications in immunological studies of communicable diseases	India <sup>f/</sup> , Iran <sup>f/</sup> , Nigeria <sup>g/</sup> , Switzerland <sup>g/</sup> , United States <sup>f/</sup>
Radioisotope and radioactivation techniques and their applications in studies of vectors and parasites of medical importance	Uganda
Radiopharmaceuticals and techniques for scintigraphy and their applications	Brazil, India, Israel, Poland, Uruguay, Viet-Nam
Radioisotope techniques in cardiovascular studies	Argentina (2), Hungary, Spain

<sup>a/</sup> Part of a co-ordinated research programme on the use of radioisotopes in the study of malnutrition in tropical and sub-tropical regions.

<sup>b/</sup> Cost-free research agreement.

<sup>c/</sup> Part of a joint Agency/WHO co-ordinated research programme on iron nutrition.

<sup>d/</sup> Technical contract.

<sup>e/</sup> Part of a co-ordinated programme on the medical applications of activation analysis.

<sup>f/</sup> Part of a co-ordinated research programme on the use of antigens labelled with radioisotopes in serological epidemiology.

<sup>g/</sup> Part of a co-ordinated research programme on the development of the technique and application of the method of radioactive single radial diffusion.

[9] GC(XIII)/404, para. 43.

33. The first three programmes are being phased out, while the support of the others which were started early in 1969 is being increased.

34. Other activities during the year, relating to radioisotope applications in medicine, included:

- (a) A panel on the standardization of radioisotope techniques in diagnostic haematology, held jointly with the International Committee for Standardization in Haematology, in Vienna in August 1969, which made recommendations for the standardization of such techniques;
- (b) A symposium on in vitro procedures with radioisotopes in clinical medicine and research, held in Vienna in September 1969; it was the first meeting on this subject to be organized by the Agency;
- (c) A panel on the measurement of radioisotope uptake in body organs, held in Vienna in December 1969, which reviewed the present status of techniques for such measurements;
- (d) An advanced training course on medical applications of radioisotopes, held in Khartoum, Sudan in January/February 1970;
- (e) A panel on the preparation and control of radiopharmaceuticals from generator-produced radioisotopes in medical radioisotope laboratories, held in Vienna in May 1970, which reviewed the present status of techniques in this subject; and
- (f) A study tour on in vivo radioisotope measurement techniques in medicine, visiting the Czechoslovak Socialist Republic, Denmark, Sweden and the Soviet Union from May to June 1970.

#### Dosimetry

35. The postal dose intercomparison service which was started in 1968 to help laboratories and hospitals in various countries to improve dosimetry in radiotherapy centres is proving successful. One hundred and eighty dosimeters have been posted to institutions in 41 developing countries. The programme has been helped by the gift from the United States of a teletherapy shield and 3000 Ci cobalt-60 radiation source to the Agency's dosimetry laboratory.

36. A joint Agency/WHO panel was convened in Risø, Denmark, in May 1970 to discuss problems of absolute radiation dose determination and absorbed dose standards. The meeting helped to prepare international recommendations on absolute dose measurement and on the role that the Agency could play in setting up secondary standard laboratories in co-operation with WHO.

37. The programme on dosimetry is now giving support to a total of eight research projects summarized in the following table.

Table 8

Distribution of research contracts  
on dosimetry

Research programme	Countries in which research is conducted with Agency support
Studies of the physical factors influencing relative biological effectiveness of ionizing radiations	Netherlands <sup>a/b/</sup> , United Kingdom (2 <sup>a/b/</sup> +1 <sup>b/</sup> )
Development of new dosimetric techniques	Belgium, Japan, United States
Development of dosimetric systems for intercomparison purposes	Federal Republic of Germany

<sup>a/</sup> Part of a co-ordinated research programme on the biophysical aspects of radiation quality.

<sup>b/</sup> Cost-free research agreement.

## PHYSICAL SCIENCES

Physics

38. The broad objectives of the Agency's programme on physics were described in last year's report [10]. The programme tends to concentrate on the physics of fission, fusion and neutron physics; it gives special emphasis to projects that can lead to practical applications, provide the scientific basis for the long-term development of technology or help developing countries to do significant work in nuclear physics research or training. Table 9 below summarizes the present research support programmes.

Table 9

## Distribution of research contracts on physics

Research topic	Countries in which research is conducted with Agency support
Neutron and nuclear physics	Belgium, Brazil, Hungary, Poland, Yugoslavia
Fission physics	India, Italy, Romania
Solid-state physics and radiation damage	Denmark, Romania, South Africa, Soviet Union (2), United Kingdom

39. Individual projects undertaken include:

- (a) The Agency's second symposium on physics and chemistry of fission, held in Vienna in August 1969, where important experimental and theoretical advances were described;
- (b) A panel on instrumentation for neutron inelastic scattering research, in Vienna in December 1969. The results of this meeting provide valuable information on contemporary techniques and methods for neutron scattering research, and illuminate its many applications in research on matter;
- (c) A meeting of the Joint ENEA/IAEA Liaison Group on thermionic electrical power generation, in Moscow in February 1970, which discussed the status of thermionic work in each of the countries represented, and revised the draft of a technical glossary aimed at standardizing international terminology;
- (d) A consultants' meeting on fusion research, in Vienna in February 1970 to explore the needs for increased international co-operation in this area in view of recent encouraging progress; and
- (e) A panel on international co-operation in controlled thermonuclear research and its applications, in Trieste in June 1970, as a result of the consultants' meeting mentioned above. A status report on fusion research was elaborated and concrete proposals were made for the Agency's role in this matter.

Nuclear data

40. At a meeting of the four main international data centres - Brookhaven, Obninsk, Saclay (ENEA) and the Agency - at Moscow in November 1969, agreement was reached on the final adoption of a computer format for the exchange of experimental data. This system includes the exchange of magnetic tapes between Obninsk and the other three centres; as far as is

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[10] Ibid., para. 52.

known, it is the first international arrangement of this kind and may be of importance for other fields of scientific exchange. The volume of exchange of evaluated neutron data is also increasing considerably which is of special practical value to reactor designers and other technological users of nuclear data.

41. Other work of the Agency's Nuclear Data Section and of INDC includes preparation of a world-wide request list for nuclear data measurements, a collection of requests for targets and samples for the neutron data measurement programmes of developing countries and a second international conference on nuclear data for reactors in June 1970, in Helsinki, which was preceded by special meetings on  $\alpha$ (Pu-239) and  $\bar{\nu}$ , Studsvik, Sweden. The conference assessed the present status of measurement and evaluation in important areas of neutron physics data, and provided guidelines for further research.

42. The 1969 revision of the 220 m/sec neutron constants for the main fissionable nuclei, performed as a co-operation work of Agency consultants and the Nuclear Data Section, has received world-wide recognition. It provided basic standards for neutron data normalization and served as a prototype example for future neutron data reviews to be performed by the Agency.

### Chemistry

43. Individual projects within the Agency's programme on chemistry included:

- (a) A panel on the quality control of radiopharmaceuticals, held in Vienna in July 1969 which was the first activity of the Agency in this field; and
- (b) A study group meeting on the production of radioisotopes and radiopharmaceuticals, held at São Paulo in October 1969, which acquainted the Latin American participants with the most recent advances in the topic, and stimulated interest in the production and control of radiopharmaceuticals.

44. A research contract on some aspects of the properties and utilization of tritium is being carried out in Indonesia.

### Isotope hydrology

45. The Agency is continuing to collect and publish data on environmental isotopes in precipitation in a world-wide network; it is carrying out sub-contracts under UNDP(SF) water development projects in Algeria, Chad, Greece, Jordan, Nicaragua, Niger, Senegal, Spain and Tunisia and is collaborating with some Member States in specific problem studies.

46. The working group on nuclear techniques in hydrology of IHD, for which the Agency provides the technical secretariat, held its fourth session. It is now preparing a document on nuclear logging in hydrology. A symposium on the use of isotopes in hydrology was held in Vienna, in March 1970; it was followed by a special panel on the use of carbon isotopes in hydrology. An interregional training course on isotope hydrology took place in São Paulo in October/November 1969. The Agency also provided lecturers in hydrology courses organized within the framework of IHD.

47. The Agency has provided technical assistance relating to isotope hydrology to Brazil, Hungary, India, Iran, Nigeria, Poland and Yugoslavia.

Table 10

## Distribution of research contracts on radioisotope applications in hydrology

Research topic	Countries in which research is conducted with Agency support
Basic research	Belgium <sup>a/</sup> , Chile, Hungary (2), Kenya <sup>b/</sup>
Development of field methods	New Zealand <sup>a/</sup> , Pakistan, Poland, South Africa, Spain, United Arab Republic
Field application of isotope techniques to specific problems	Chile, China, Denmark <sup>a/</sup> , Hungary, Romania (2), Senegal, Turkey, United States of America <sup>a/</sup>

<sup>a/</sup> Technical contract.

<sup>b/</sup> Cost-free research agreement.

Industry

48. Developing Member States are showing increasing interest in industrial nuclear techniques including those used for radiation processing, in mining and mineral surveys and for pollution control. This interest is shown in several proposals for UNDP(SF) projects that are now being examined, including a sub-regional demonstration programme for three Member States in the Far East on the use of radiation techniques for wood plastic composites.

Table 11

## Distribution of research contracts on radioisotope applications in industry

Research topic	Countries in which research is conducted with Agency support
Neutron moisture gauging	Czechoslovak Socialist Republic, Denmark <sup>a/b/</sup> , Madagascar <sup>b/</sup> , Poland <sup>a/c/</sup>
Impregnated fibrous materials	China, Finland, Iraq, Romania
Isotopic ratios in oil field evaluation	Romania
Analysis of ores by activation analysis	Czechoslovak Socialist Republic, Poland
Tracer techniques in water pollution	Yugoslavia

<sup>a/</sup> Cost-free research agreement.

<sup>b/</sup> Part of a co-ordinated research programme on neutron moisture gauge development.

<sup>c/</sup> Part of a co-ordinated research programme in flow studies.

49. The work on the first research topic - using neutron gauges to measure moisture content in soil and building materials - was completed in November 1969, leading to a clear understanding of the advantages and limitations of these devices. The work on the processing of fibre plastic composites has been broadened to include several other Member States interested in using these composites as building materials. Research on hydrogen isotope

exchange in natural gas has been launched to develop suitable techniques for oil field evaluation, and the work on the fourth topic is intended to develop geochemical and geobotanical prospecting techniques for non-nuclear minerals.

50. Other projects during the year have included:

- (a) A symposium on the use of large radiation sources and accelerators in industrial processing, held at Munich in August 1969. One of the main results was a clear indication that the use of radiation to process polymers, plastics or textiles - e.g. "non iron" fabrics - is now becoming a routine industrial operation; and
- (b) A panel at Cracow in December 1969, which evaluated the use of nuclear techniques in locating and exploiting mineral resources (other than nuclear minerals).

#### Centres and laboratories

51. The work done recently at the Agency's Laboratory at Seibersdorf, the International Laboratory of Marine Radioactivity in Monaco and the International Centre for Theoretical Physics at Trieste is described in full in the annual report of the Agency's laboratory activities [11]. The programme of the Monaco Laboratory is now directed chiefly to problems connected with the management of radioactive wastes in the sea and the practical aspects of such management.

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[11] IAEA Laboratory Activities, Seventh Report, Technical Reports Series No. 103.

## NUCLEAR POWER AND REACTORS

General

52. Ten new power reactors became critical in 1969, raising the total installed nuclear electrical generating capacity throughout the world from 11 425 MW to 15436 MW. The net increase of 4000 MW is less than predicted a year ago because of commissioning delays. Firm orders for approximately 19 000 MW of nuclear capacity were announced, of which 6300 MW were in Europe, 7170 MW in the United States, 3000 MW in Canada and 2440 MW in Asia.

53. In 1970, 16 nuclear stations having a total electrical generating capacity of 7376 MW are expected to go on line. The situation in 1970, and forecasts for 1975 and 1980, are given in Table 12 below.

Table 12

Estimates of total and nuclear electrical generating capacity  
1970-1980 <sup>a/</sup> (1000 MW)

	1970			1975			1980		
	Total	Nuclear	Nuclear share (%)	Total	Nuclear	Nuclear share (%)	Total	Nuclear	Nuclear share (%)
Industrial countries	1000	23	2.3	1400	120	9	1950	300-330	15-17
Developing countries	135	0.5	0.3	200	5	2.5	295	20-25	7-8
World <sup>b/</sup>	1135	23.5	2.1	1600	125	8	2245	320-355	14-16

<sup>a/</sup> At the end of the year.

<sup>b/</sup> Excluding China (mainland).

54. The recent decline in orders for nuclear power reactors has slowed down uranium purchase contracts and may, in the immediate future, diminish uranium exploration in the main producing countries. Any decline is likely to be temporary, and world investment in exploration and production capacity is expected to double by the mid 1970s to meet the needs of the nuclear power industry.

55. The Agency's programme reflects the increasing commercialization of nuclear power. While the Agency continues to promote the exchange of information about the development of advanced systems, there is now more emphasis on problems of operation important both to producers and users of nuclear power plants. Forecasting and financing studies are of special value to the developing countries. Work on long-term technologies such as nuclear desalting and energy centres continues, while work on the peaceful uses of nuclear explosions is just beginning. The Agency also continues to help the developing countries to use their research reactors more efficiently and to adapt their programmes to local needs.

Technical aspects of nuclear power

56. The new generation of nuclear power reactors is beginning to yield information on performance which is of value to utilities, manufacturers and potential customers. At a



symposium on performance of nuclear power reactor components, held in Prague in November 1969, the discussions showed that despite the novelty of nuclear technology and the rapid scale-up in component sizes entailed in building nuclear power plants, their overall performance was satisfactory; most of the troubles experienced originate from the so-called conventional parts. Improved quality control in engineering and manufacturing of key components is necessary to enhance reliability and safety. Continued exchange of information on nuclear power plant operating experience was considered vital. In this connection, the Agency issued a world-wide review of operating experience in May 1970, and is continuing to collect information for annual publication.

57. A specialists' meeting on the development of advanced pressure vessel materials was held in Tokyo in July 1969. A panel of experts met in Vienna in February 1970 to discuss design criteria and safety of concrete pressure vessels. A panel on instrumentation for nuclear power plant control was held in Vienna in November 1969 and helped in exchange of experience in this area of growing significance. It recommended the publication of reviews on selected topics.

58. More countries, including a few developing ones, are taking interest in the development of fast-breeder reactors as potential sources of low-cost nuclear energy. The status of breeder systems was reviewed in an Agency symposium on progress in sodium-cooled fast reactor engineering, held in Monaco in March 1970. The topics discussed included primary components, safety, hydraulic and structural core technology. Following this symposium, the annual meeting of the international working group on fast reactors was held at Cadarache in France. This group exchanges information on fast-reactor development programmes, and recommends and co-ordinates international meetings on this subject. A specialists' meeting on sodium vapour control was also held at Cadarache, at the same time as the working group meeting.

59. The Agency continues publication of its semi-annual list of power and research reactors. The eighth volume of the Directory of Nuclear Reactors which will be published in the course of 1970, covers 57 new research, test and experimental reactors [12].

60. Many Member States are now providing the Agency with data on nuclear raw materials, thus helping it to assess exploration problems. The Joint IAEA/ENEA Study Group on uranium resources and production capacities, whose publications have become the authoritative international statements on this subject, met again in April 1970 and brought up to date the estimates of uranium reserves and resources, production capacities and short-term uranium demand.

61. With regard to the technical aspects of exploiting uranium resources, a panel in April 1970 reviewed the geology of uranium mineral occurrences and provided valuable information for defining areas where uranium exploration is likely to be profitable. Attention is also being given to the specification and calibration of prospecting instruments. A regional training course in uranium prospection in Latin America was held in Argentina in September/October 1969. Advisory services in connection with the preparation of UNDP(SF) projects on uranium exploration were provided to Greece and Pakistan. In September 1969 a technical advisory mission on exploration methods was sent to Greece. The Agency is also continuing to support research on the recovery of uranium as a by-product of other minerals.

#### Supply of nuclear materials

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

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[12] Agency publication STI/PUB/248.

Table 13

## Supply of nuclear materials

Receiving State	Purpose	Quantity and type of fissile material	Approximate enrichment (when applicable)
Bulgaria <sup>a/</sup>	Research	10.12 mg of each isotope <sup>235</sup> U, <sup>238</sup> U, <sup>232</sup> Th, <sup>238</sup> Pu, <sup>239</sup> Pu <sup>b/</sup>	
Chile	Fuel for a research reactor	9570 g <sup>235</sup> U	93%
Finland	Fuel for a research reactor to cover the estimated requirements over a five-year period	4750 g <sup>235</sup> U	20%
Finland	Fission counters	3.4 g <sup>235</sup> U	greater than 90%
Greece <sup>a/</sup>	Research	100 g <sup>235</sup> U	93%
India <sup>a/</sup>	Fission counters	45 g <sup>235</sup> U	90%
India <sup>a/</sup>	Standard reference material	1 g Pu metal	
India <sup>a/</sup>	Research	20 mg Pu in PuO <sub>2</sub>	
India <sup>a/</sup>	Research	10 mg <sup>242</sup> Pu	
Indonesia	Fuel for a research reactor	3605 g <sup>235</sup> U	20%
Yugoslavia <sup>a/</sup>	Research	50 mg <sup>233</sup> U 250 mg <sup>233</sup> U <sup>b/</sup>	

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

<sup>b/</sup> This request is connected with the execution of an Agency research contract.

63. The allocation of special fissionable material to the value of \$50 000 granted by the United States for 1969 is shown in the table below.

Table 14

## Allocation of special fissionable material granted by the United States for 1969

Receiving State	Value in dollars
Chile	23 662.50
India	2 675.00
Indonesia	23 662.50
	<u>50 000.00</u>

Economic and financing questions

64. There have been some signs that the ratio between the costs of nuclear power and fossil power is stabilizing. Inflationary pressures have driven up the capital costs of both types. This trend has been partly offset by falling costs in both the nuclear fuel cycle and in fossil fuels, particularly heavy fuel oil. It is expected that nuclear fuel cycle costs will remain steady or decline further, savings in fabrication and reprocessing costs more than offsetting nominal increases in ore and enrichment costs. It is to be noted, however, that the trend towards higher capital costs and lower fuel costs works in favour of fossil power.

65. These trends have general significance only. They were discussed at the symposium on nuclear energy costs and economic development held at Istanbul in October 1969, and it was emphasized that the only cost comparisons of practical value are those based specifically on the conditions at a given site in a given country. The rate at which nuclear power spreads in the developing countries will also be greatly affected by the terms on which investment capital is available.

66. Pursuant to General Conference, Resolution GC (XIII)/RES/256, the Secretariat is preparing estimates of the financial requirements of developing countries for nuclear projects in the next decade, and surveying possible sources of finance. Information already received shows that developing countries expect to install 20 000 to 25 000 MW(e) of nuclear capacity between 1970 and 1980, which would require foreign exchange resources of 3-4 billion dollars. Between 1980 and 1985 these countries expect to commission an additional 25 000 to 35 000 MW(e) of nuclear capacity, which would probably involve foreign currency requirements of the order of 4-6 billion dollars (depending on reactor type and domestic industry's participation), for which credits and loans would presumably have to be obtained before the end of the present decade.

67. The co-ordinated research programme on the technical and economic assessment of intermediate-sized nuclear power plants, mentioned in last year's report [13], has now been launched and a number of advanced countries are taking part in it at their own expense. The results should be available by the end of 1970. The Agency also arranged a second international survey course on economic and technical aspects of nuclear power, in Vienna, in September 1969, to review nuclear power questions of special interest in planning and carrying out nuclear power programmes. The course was designed for senior engineers and scientists who deal with nuclear power programmes in developing countries; details of participation are given in Table 4 above.

Nuclear desalting and energy centres

68. At the symposium in Istanbul, mentioned in paragraph 65 above, there was a special discussion of the prospects for major agro-industrial complexes based on very large nuclear reactors. Participants felt that it was important to have an assessment of the indirect as well as the direct economic benefits that such centres might offer. It would also be desirable to develop special agricultural techniques to take advantage of the characteristics of desalted water and to establish experimental farms in arid regions. In this connection the Agency is keeping in touch with the Oak Ridge National Laboratory of the United States regarding the study of the agro-industrial complexes in the Middle East [14]. No decision has yet been reached on the recommendations of the joint Agency/Mexico/United States feasibility study of a large dual-purpose plant near the head of the Gulf of California [15].

Nuclear explosions for peaceful purposes

69. In accordance with the recommendations of the General Conference, the Agency is emphasizing initially the exchange of technical information. A panel on the peaceful uses

[13] GC(XIII)/404, para. 76.

[14] Ibid., para. 79.

[15] Ibid., para. 80.

of nuclear explosions, the first international technical meeting on this subject, was held in early March 1970. It attracted wide interest and besides the eight panel members, there were 49 other representatives or observers from 29 Member States, the United Nations and WHO. The participants summarized and discussed current knowledge with regard to the phenomenology of contained and of cratering explosions. In May 1970 the Agency issued a bibliography on peaceful nuclear explosions containing 1759 references to literature published up to June 1969. On the advice of the panel and with the help of consultants, the Secretariat is preparing a comprehensive introductory review which will summarize the already extensive literature on the subject, and a multilingual glossary of specialized terms used in this field of work.

#### Reactor physics and reactor research

70. Following the recommendations of a panel in November 1969, the Agency is taking steps to help developing countries to make greater use of computer programmes, for instance in making economic and technical evaluations of power reactors. The Agency is also encouraging the dissemination of code systems suitable for smaller computers. Some parts of the programme are being carried out in co-operation with ENEA's computer library at Ispra, Italy [16].

71. A regional research reactor utilization study group meeting was held in Casaccia, Italy, in February 1970 and gave special attention to the role of such reactors in promoting nuclear and solid state physics and radioisotope production in Eastern Europe and the Middle East.

72. The collaboration under the Agreement between the Agency and the Governments of Norway, Poland and Yugoslavia concerning Co-operative Research in Reactor Physics (NPY Agreement) [17] proved the usefulness of such co-operative work, and the three Governments expressed the wish to broaden the technical area of their co-operation. To this end they proposed to the Agency the conclusion of an agreement for co-operative research in reactor science that would broadly follow the lines of the NPY Agreement; the Board approved this new agreement for the duration of one year at its meetings in February, and the agreement entered into force on 10 April.

73. The Agency arranged for 16 scientists from eight countries to take part in a project for intercomparison of standard calorimeters, at Grenoble, France, in March 1970. The Agency is also continuing to develop simplified methods of reactor neutron flux and spectrum monitoring, particularly with regard to agricultural and biological irradiation chambers which have been specially designed for use in small research reactors in developing countries.

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[16] See para. 92 below.

[17] INFCIRC/55 and Add.1.

## HEALTH, SAFETY AND WASTE MANAGEMENT

General

74. Besides the continuing task of revising the Agency's regulations and recommendations covering most types of nuclear activities and facilities, special attention has been given to two matters:

- (a) The problem of radioactive environmental pollution; and
- (b) Helping developing countries and their national nuclear centres. Five guide books on radiological safety; two on nuclear safety and two on waste management were published. A mission visited Bulgaria, Hungary and Romania to advise on accident neutron dosimetry and on nuclear dosimetry.

75. There has also been a further increase in the amount of radiation protection work at the Agency's own laboratories and in connection with safeguards inspections.

Research support

76. Tables 15 and 16 below show the distribution of research contracts and agreements relating to radiation protection and waste management.

Table 15

## Distribution of research contracts radiation protection

Research topic	Countries in which research is conducted with Agency support
General matters of radiation protection	Czechoslovak Socialist Republic (2), Italy, Romania
Measurement techniques	Brazil, France, Federal Republic of Germany, India, Republic of Korea, Poland (2)
Co-ordinated research in accident dosimetry	Czechoslovak Socialist Republic <sup>a/</sup> , France <sup>a/</sup> , Federal Republic of Germany <sup>a/</sup> , Hungary <sup>a/</sup> , Yugoslavia <sup>a/</sup>
Transport packagings	Sweden

<sup>a/</sup> Cost-free research agreements.

Table 16

## Distribution of research contracts on environmental pollution and waste management

Research topic	Countries in which research is conducted with Agency support
Research in marine radioactivity	Argentina <sup>a/</sup> , Finland <sup>a/</sup> , India <sup>a/</sup> , Israel, Italy <sup>a/</sup> , Japan <sup>a/</sup> , Netherlands <sup>a/</sup> , Norway <sup>a/</sup> , Poland <sup>a/</sup> , Romania <sup>a/</sup> , Spain, (1 + 1 <sup>a/</sup> ), United Kingdom, Yugoslavia <sup>a/</sup>
Low- and medium-level radioactive waste management	Bulgaria, Chile, China, Federal Republic of Germany <sup>a/</sup> , Hungary, India, Republic of Korea, Pakistan, Philippines, Romania, Union of Soviet Socialist Republics, United Arab Republic, Yugoslavia

<sup>a/</sup> Cost-free research agreement.

Radiological safety

77. A symposium on radiation safety problems of "hot" facilities at Saclay, France, in October 1969, gave special attention to the safety aspects of design, maintenance, ventilation and radiation monitoring, and provided a useful exchange of operational experience.

78. In December 1969 the Agency, in collaboration with WHO, convened a study group on radiation protection legislation at the Agency's Headquarters. One of the results is that the Agency and WHO will jointly publish guidelines to help Governments to draft radiation protection legislation. The guidelines will include a report on radiation health legislation prepared by WHO.

79. Details of a training course held at Teheran, Iran, in September 1969, on planning for the handling of radiation accidents, are given in Table 4 above.

80. The review of the Agency's Regulations for the Safe Transport of Radioactive Materials, mentioned in last year's report [18], is now proceeding and it is expected that it will be completed by 1972. Meetings were held at the Agency's Headquarters in December 1969, January 1970 and February 1970, with a view to ensuring the widest participation of interested Governments and experts in the review. It may be mentioned that the new edition of the relevant regulations of IATA now contains a single set of provisions for the transport of radioactive materials by air, which conform closely to the Agency's own regulations. The Agency's regulations have now been incorporated in the international regulations governing transport of radioactive materials by rail, sea, air, road and by inland waterways.

81. During the period covered by this report the following manuals and guides were issued:

Planning for the Handling of Radiation Accidents (Safety Series No. 32);

Guide to the Safe Design, Construction and Use of Radioisotopic Power

[18] GC(XIII)/404, para. 87.

Generators for Certain Land and Sea Applications (Safety Series No. 33);

Personnel Dosimetry Systems for Exposure to External Radiation (Technical Report Series No.109); and

Directory of whole-body radiactivity monitor.

82. Groups of consultants met in Vienna to prepare a manual of guidance on calibration facilities and revised version of The Safe Handling of Radioisotopes (Safety Series No.1).

#### Waste management

83. In October 1969 a group of experts studied the questions that may arise from the re-release of radioactive noble gases (particularly krypton-85) in the reprocessing of nuclear fuel, and concluded that they will not cause a national, much less a world-wide, public health problem in the foreseeable future. If it is desired, for special reasons, to separate (and subsequently to contain) noble gases from these or other gaseous exhausts, the necessary technical processes already exist.

84. Another group of experts in August 1969 recommended standard methods for measuring the leach-rate of fission products from solidified waste, a question of importance when such waste is disposed of into the sea or the ground.

85. During the period covered by this report the Agency issued two publications entitled Standardization of Radioactive Waste Categories (Technical Report Series No. 101) and Volume Reduction of Solid Radioactive Wastes (Technical Report Series No.106).

#### Nuclear safety

86. As indicated in paragraph 69 above, the Agency is promoting the exchange of information on the peaceful uses of nuclear explosives including the safety aspects thereof. The Agency made a siting evaluation for a nuclear power plant in Mexico in September 1969, sent a mission to Pakistan in October in connection with a review of the safety of the Karachi nuclear power plant, sent a preliminary siting mission to Yugoslavia in June 1970 in connection with a nuclear power plant, and made safety report evaluations for research reactors in Chile and Greece.

87. The code of practice for the safe operation of critical assemblies and research reactors mentioned in paragraph 99 of last year's report, has been co-sponsored by WHO. A code of practice on the safe operation of nuclear power plants, including technical appendices, and a manual of the guidelines for the layout and contents of safety reports for stationary nuclear power plants have been published.

## INFORMATION AND TECHNICAL SERVICES

INIS

88. By 30 June 1970, 35 countries and four international organizations had agreed to participate in INIS, thus assuring it of a coverage of at least 90% of the sources of the world's nuclear publications. INIS started its output in the beginning of May 1970, distributing magnetic tapes, announcement bulletins and microfiches that covered the literature reported to INIS up to 1 April 1970. One month is thus allowed for processing material received by the Agency. In the outputs of May and June, data respecting 533 items of literature were reported out by the system.

89. In accordance with the Board's decision, the subject scope is initially limited and covers:

- (a) Reactors and reactor materials;
- (b) Uranium production and fuel cycles;
- (c) Nuclear techniques in food and agriculture;
- (d) Health, safety and waste management;
- (e) Isotope production;
- (f) Industrial applications of radiation;
- (g) Peaceful nuclear explosions; and
- (h) Safeguards, legal and economic questions.

It will be noted that this range does not at present include basic sciences such as physics, chemistry and biology.

90. In May 1970 EURATOM completed its contract to provide the Agency with a thesaurus of key words and an instruction manual that Member States will use for assigning key words to individual items of literature. Member States will soon be requested to include key words in their input to the Agency and the future output of INIS will carry these terms.

Computer services

91. By 30 June 1970 the Agency's computer was operating about one and a half shifts per day. Initially the administrative and financial operations of the Agency were programmed, but the emphasis is now moving to work on INIS, safeguards and scientific problems. Under an agreement with UNIDO, the latter has full access to the computer and reimburses the Agency for the time used.

92. Since March 1968, ENEA's computer programme library at Ispra, Italy [19], has provided computer programmes and other services to Members of the Agency that are not members of ENEA. The Agency out-posts one scientist from its staff to arrange this service. During the year, 35 programmes were made available to non-ENEA countries and seven were donated by such countries to the library.

Scientific meetings

93. Comparative information for 1968 and 1969 in respect of conferences, symposia and seminars, is given in the following table:

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[19] See para. 70 above.



Table 17

## Conferences, symposia and seminars

Item	1968	1969
Meetings	13	11
Participants	2665	1906
Countries taking part	65	64
Papers presented	974	576

94. In February 1970 the Agency held the first international meeting on the handling of nuclear information, which attracted information scientists and librarians from many parts of the world to exchange ideas about the services they provide to their scientific and engineering communities.

Publications

95. The table below shows a break-down of the Agency's publications by subject:

Table 18

## Publications

Subject	1968 %	1969 %
Nuclear power and reactors	25	14
Nuclear research	20	29
Health, safety and waste management	9.5	8
Food and agriculture	10	11.5
Life sciences	6.5	9.5
Theoretical physics	3.5	4
Public information	4	4
References and miscellaneous	21.5	20

96. Revenues from sales and publications amounted to \$165 855 in 1969 whereas the commercial value of publications distributed free to Member States amounted to \$450 000.

Other activities

97. The Agency continues to publish the Atomic Energy Review, Nuclear Fusion and Meetings on Atomic Energy on a quarterly basis, and circulation of these periodicals is slowly but steadily increasing.

98. The holdings of the Library and its activities are summarized in the following tables.

Table 19

## Library holdings

Holdings	31 Dec 1968	31 Dec 1969
Books and bound periodicals	29 737 <sup>a/</sup>	31 217
Technical reports (microfiche, hard copy)	110 531 <sup>a/</sup>	118 940
Periodical subscriptions	1 193 <sup>a/</sup>	1 254
Film titles	429 <sup>a/</sup>	456

<sup>a/</sup> The discrepancy between these figures and those given in Table 17 of last year's report (document GC (XIII)/404) is due to estimates being replaced by actual counts.

Table 20

## Library services

Services	1968	1969
Loans to Member States (Books and periodicals)	757	580
Circulation within Secretariat (Books, documents, periodicals, microfiche and other loans)	48 040	45 793 <sup>a/</sup>
Pages of xerox copies	121 005	71 193 <sup>b/</sup>
Film loans to Member States	805	921

<sup>a/</sup> The decrease is due to an intensive overhaul of the automatic circulation of periodicals to staff members.

<sup>b/</sup> The decrease is due to an effort to obtain economies by more closely supervising the use of the machine for copying Library materials.

## SAFEGUARDS

Implementation of Agency safeguards

99. As shown in Table 22 at the end of this section, by 30 June 1970 the Board had approved a total of 44 safeguards agreements involving 32 States [20].

100. During the period covered by this report, the Board approved:

- (a) An agreement for the application of safeguards to a 40-MW research reactor facility, which the Government of the Republic of China intends to obtain from a manufacturer in Canada;
- (b) A Safeguards Transfer Agreement in connection with the bilateral co-operation agreement between the Governments of Pakistan and Canada;
- (c) A project agreement between the Agency and the Government of Chile, which will bring a 5-MW(th) pool-type reactor under Agency safeguards;
- (d) A project agreement between the Agency and the Government of Indonesia, which will bring an additional core load for the Triga Mark II research reactor under Agency safeguards; and
- (e) A Safeguards Transfer Agreement in connection with the bilateral co-operation agreement between the Governments of India and the United States.

101. New Safeguards Transfer Agreements replaced expired ones with the countries mentioned below on the dates shown against them:

Argentina/United States	25 July 1969
Canada/Japan	12 November 1969
Portugal/United States	19 July 1969.

102. When all the agreements listed in Table 22 come into force, they will cover the reactor facilities, nuclear power stations, and the plants listed in Table 23. Four new nuclear power stations, Tsuruga in Japan (357 MW(e)), Santa Maria de la Garona in Spain (440 MW(e)), Kanupp in Pakistan (137 MW(e)) and Tarapur in India (380 MW(e)) have come or are now coming under Agency safeguards; the first two under existing agreements and the third and fourth under the new agreements mentioned in sub-paragraphs 100(b) and (e) above. Besides these one other nuclear power station in Japan, one in the United Kingdom and one in the United States are under Agency safeguards. The following table illustrates the status of safeguards work on 30 June 1970 [21].

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[20] For the purpose of these statistics a safeguards agreement is taken as any agreement to which the Agency is a party that specifies safeguards are to be applied. This means that agreements expressly exempting from safeguards the material covered are not included, but agreements under which materials may be exempted later are included as long as exemption has not been granted.

[21] For comparison see Table 18 of last year's report (document GC (XIII)/404).

Table 21

## Status of safeguards work

Description	30 June 1970
Nuclear power stations	10
Other reactors	68
Conversion plants, fabrication plants and fuel reprocessing plants	4
Other separate accountability areas	74

103. As of 31 December 1969 the following quantities of nuclear material were under Agency safeguards:

- (a) Source material            1070 tons;
- (b) Enriched material        522.13 kg (effective); and
- (c) Plutonium                823.93 kg.

104. As foreseen in last year's report [22], the second inspection of the Nuclear Fuel Services Incorporated plant at West Valley, New York, was completed in July 1969. It provided valuable information for the purposes of systems analysis and statistical studies, as well as some useful experience in the safeguarding of reprocessing facilities.

105. The co-operation with Denmark in developing safeguards instruments was also mentioned in last year's report [23]. A year-long test on a thermal power integrator and a neutron flux integrator provided by Denmark has been successfully completed. They were installed at the Danish DR-3 research reactor and sealed by the Agency. In the test the difference between the reported integrated power and the recorded integrated power was below one percent and therefore fully acceptable for safeguards purposes.

106. Similarly an experiment carried out at the Zebra fast critical assembly at Winfrith, United Kingdom, has helped the Agency to develop quantitative procedures for applying safeguards to stored plutonium. The instruments used - a British portable gamma spectrometer and ancillary equipment designed by the Agency - make it possible, to verify by physical measurement and within a prescribed degree of accuracy, that the amount of plutonium in store corresponds to the amount reported in the book inventory. These instruments as well as those provided by the United States are now in routine use [24].

107. During the period covered by this report 139 inspections were made in 17 Member States compared with 64 in 11 Member States during the preceding 12 months. Seven pre-operational visits were made in five Member States compared with three such visits in three Member States in 1968-69.

[22] GC(XIII)/404, para. 115.

[23] Ibid., para. 122.

[24] Ibid., paras 120 and 121.

Notification of transfers of nuclear materials

108. Canada and the United States sent notifications of international transfer of nuclear materials that are not under Agency safeguards, covering the period of 1 January to 30 June 1969, and the United States sent a further notification covering the period 1 July to 31 December 1969.

Research and development programme

109. The following are some of the main steps that have been taken with a view to ensuring that the Agency's safeguards methods and techniques are adequate to deal with the growing number of facilities and quantity of material under safeguards:

- (a) The report of the group of consultants, appointed at the end of 1968, is serving as a basis for work on systems analysis for safeguarding the entire nuclear fuel cycle. The consultants' recommendations are also being taken into account in preparing safeguards agreements and in carrying out the routine safeguards work. The summary of the report was distributed to the Board in October 1969, and each Member State has received a copy;
- (b) A panel on safeguards systems analysis of nuclear fuel cycles met in Vienna in August 1969 and reviewed the Agency's programme for systems analysis; a panel on safeguards methods and techniques met in Tokyo in December 1969; and
- (c) The discussions at these two panel meetings and the consultants' report have enabled the Secretariat to finalize its programme of systems analysis and to obtain agreement on the programme by most specialists involved. The two panels have also confirmed the importance of the technique of material balance accounting. The "material balance area" is therefore becoming the fundamental concept for determining what information is needed for design review, what records and reports systems should be established for safeguards purposes, what inspection procedures should be employed and what the relationship should be between inspections and reports. The panel held at Tokyo helped the Secretariat to translate the concept of material balance accounting into detailed guidelines, for instance, how to quantify the results of inspections, what approach should be taken in regard to materials unaccounted for, to scrap and to discard, and what factors should influence the frequency of taking physical inventories.

110. With regard to systems analysis, the task of studying the nuclear power programmes of Member States is nearing completion. The Secretariat has selected the reactor data needed for calculating fuel requirements for PWR, BWR, AGR, HWR and Magnox reactors. Models of various fuel cycles have been selected for computer simulation, and computer programmes have been made for calculating distribution of quantities of nuclear material between individual facilities and Member States. Print-outs have been obtained for inventory and throughput of quantities of nuclear material in various parts of the fuel cycle. This work shows that the main safeguards tasks, by 1980, will be the safeguarding of the very large quantities (in terms of potential diversion risk) of plutonium that will have been accumulated by that date.

111. Standard questionnaires are being elaborated; they will be used to obtain information for the design review of most types of nuclear facilities and to define the information that must be kept for safeguards purposes in operators' records and that must be submitted in reports to the Agency. Work is also being done to standardize safeguards terminology.

112. A safeguards technical working group consisting of experts from ten Member States met in Vienna from 13 to 17 April 1970 to study a Secretariat working paper on design information requirements. A revised draft of the working paper reflecting the collective viewpoints of the experts was prepared. A final draft of design information requirements for all reactor types, conversion, fabrication, and reprocessing plants and storage areas

will soon be available. A similar programme designed to standardize safeguards terminology is in progress.

National research and development programme

113. The following are some of the main topics dealt with in reports received:

- (a) Experiments carried out by the Kernforschungszentrum at Karlsruhe, Federal Republic of Germany, on inspection and plant performance at a reprocessing plant and a pilot plutonium fabrication plant;
- (b) The use in the United States of the "minor isotope safeguards technique"; this technique may be useful for identifying fuel from different reactors and evaluating physical inventories in reprocessing plants during continuous operation;
- (c) The safeguards effectiveness of inspection involving an independent materials balance of plutonium at a United States spent fuel processing plant demonstrated a detection level of 1.2% of plutonium throughput; and
- (d) A number of non-destructive assay techniques have been developed for measurement of fissile content of fuel materials and are being demonstrated in United States fuel fabrication facilities.

114. In paragraphs 105 and 106 above, progress in the use of instruments is reported. The Agency is also testing seals and sealing techniques. The United Kingdom is developing a compact coulometer which can be used for measuring the uranium and plutonium in a wide variety of samples by destructive techniques. The Soviet Union is developing a technique and portable equipment to enable inspectors to measure rapidly the amount of plutonium and uranium in the liquid wastes of reprocessing plants. Based on the Agency's experience of the gamma and neutron coincidence meter which is used to measure the contents of unirradiated safeguards fuel, a new and more advanced model has been developed.

115. Fifteen research and technical contracts for the development of safeguards methods and techniques were current during the period covered by this report. Table 24 at the end of this section shows the institutes to which research contracts were awarded, the topic and approximate duration of the contracts and the amount of the Agency's contribution. The total value of these contracts is \$103 800. Additionally, the United Kingdom is co-operating with the Agency in the installation and design of instrumentation to monitor the movement of spent fuel from the Bradwell reactor core through the discharge chute, and for photographic surveillance of reactor charge face and of the spent fuel storage. This is not in the form of a formal contract.

Table 22

Safeguards Agreements approved by the Board of Governors  
(except those that have expired or been cancelled)

State(s)	Subject	Entry into force	INFCIRC
<u>Project Agreements</u>			
Argentina	RAEP Reactor	1 Dec 1964	62
Chile	Herald Reactor	19 Dec 1969	137
Congo, Democratic Republic of the	TRICO Reactor	27 Jun 1962	37
Finland	FiR-1 Reactor	30 Dec 1960	24
	FINN sub-critical assembly	30 Jul 1963	53

State(s)	Subject	Entry into force	INFCIRC
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
Pakistan	PRR Reactor	5 Mar 1962	34
Philippines	PRR-1 Reactor	28 Sep 1966	88
Spain	Coral I Reactor	23 Jun 1967	99
Uruguay	URR Reactor	24 Sep 1965	67
Viet Nam	VNR-1 Reactor	16 Oct 1967	106
Yugoslavia	TRIGA II Reactor	4 Oct 1961	32

#### Transfer Agreements

(Bilateral co-operation agreements between the indicated States)

Argentina/USA	25 Jul 1969	130
Australia/USA	26 Sep 1966	91
Austria/USA	13 Dec 1965	76
Brazil/USA	31 Oct 1968	110
Canada/Japan	12 Nov 1969	85
China/USA	29 Oct 1965	72
Colombia/USA		
Denmark/UK	23 Jun 1965	63
Denmark/USA	29 Feb 1968	112
Greece/USA	13 Jan 1966	78
India/USA		
Indonesia/USA	6 Dec 1967	100
Iran/USA	20 Aug 1969	127
Israel/USA	15 Jun 1966	94
Japan/USA	10 Jul 1968	119
Japan/UK	15 Oct 1968	125
Korea/USA	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
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	Taiwan Research Reactor Facility	13 Oct 1969	133
Mexico	All nuclear activities	6 Sep 1968	118
United Kingdom	Bradwell facility	1 Sep 1966	86
United States	Yankee Nuclear Power Station	1 Aug 1964	57
	Brookhaven graphite research reactor		
	Brookhaven medical research reactor		
	Piqua Nuclear Power Station		

Table 23

Nuclear installations under Agency safeguards or containing safeguarded material under agreements approved by the Board of Governors <sup>a/</sup>

A. Reactors<sup>b/</sup> other than power reactors

Member State	Name of reactor	Location	Type	Capacity MW(th)	In operation	Maximum routine inspections per year <sup>c/</sup>
Argentina	RA-0/Argentine Reactor 0	Constituyentes	Tank	.00	x	0
	RA-1/Argentine Reactor 1	Constituyentes	Argonaut	.10	x	0
	RA-2/Argentine Reactor 2	Constituyentes	Argonaut	.00	x	1
	RA-3/Argentine Reactor 3	Ezeiza	Pool-tank	5.00	x	1
Australia	HIFAR	Lucas Heights	Tank	10.00	x	2
	MOATA	Lucas Heights	Argonaut	.01	x	3
Austria	SAR/Argonaut Graz Research Reactor	Graz	Argonaut	.00	x	0
	AUSTRIAN TRIGA MARK II Research Reactor	Vienna	Triga II	.25	x	0
	ASTRA	Seibersdorf	Pool-tank	5.00	x	2
Brazil	IEAR-1	São Paulo	Pool	5.00	x	2
	TRIGA I	Belo Horizonte	Triga I	.00	x	0
	ARGONAUT	Rio de Janeiro	Argonaut	.00	x	0
(Colombia)	(IAN-R <sub>1</sub> )	Bogotá	Light-water	.10	x	0
Chile	Herald Reactor	Santiago	Herald	5.00		2
China	THOR/Tsing Hua Open Pool Reactor	Hsin-chu	Pool	1.00	x	1
	Taiwan Research Reactor Facility	Huaitzupu	NRX	40.00		
Congo, Democratic Republic of the	TRICO	Kinshasa	Triga I	.05	x	0
Denmark	DR-1	Risø	Homogeneous	.002	x	1
	DR-2	Risø	Tank	5.00	x	2
	DR-3	Risø	Tank	10.00	x	3
Finland	FIR-1	Otaniemi	Triga II	.25	x	0
Greece	GRR/Greek Research Reactor	Athens	Pool	1.00	x	1
Indonesia	TRIGA II/Bandung	Bandung	Triga II	.25	x	0
Iran	UTRR	Teheran	Pool	5.00	x	2
Israel	IRR-1	Yaven	Pool	5.00	x	2
Japan	JRR-1/Japan Research Reactor 1	Tokai-mura	Aqu.-hom.	.05	x	0
	JRR-2/Japan Research Reactor 2	Tokai-mura	Tank	10.00	x	3
	JRR-3/Japan Research Reactor 3	Tokai-mura	Tank	10.00	x	1
	JRR-4/Japan Research Reactor 4	Tokai-mura	Pool	1.00	x	1
	JPDR/Japan Power Demonstration Reactor	Tokai-mura	Boiling-water	46.70	x	2
	SHCA/Semi-Homogeneous Critical Assembly	Tokai-mura	Crit. Fac.	.00	x	0
	AHCF/Aqueous Homogeneous Critical Facility	Tokai-mura	Crit. Fac.	.00	x	0
	TCA Tank-Type Critical Assembly	Tokai-mura	Crit. Fac.	.00	x	0
	Sumitomo Critical Assembly	Tokai-mura	Crit. Fac.	.00	x	0
	Rikkyo University Research Reactor	Yokosuka-shi	Triga II	.10	x	0
	Musashi College of Technology Research Reactor	Kawasaki-shi	Triga II	.10	x	0
	Kinki University	Fuse-shi	UTR-B	.00	x	1



Member State	Name of Reactor	Location	Type	Capacity MW(th)	In opera- tion	Maximum routine inspections per year <u>c/</u>	
Japan (cont.)	Research Reactor TTR/Toshiba Training Reactor	Kawasaki-shi	Pool	.03	x	0	
	HTR/Hitachi Training Reactor	Kawasaki-shi	Pool	.10	x	1	
	HCA/Hitachi Critical Assembly	Kawasaki-shi	Crit. Fac.	.10	x	1	
	Nippon Atomic Industry Group Critical Assembly	Kawasaki-shi	Crit. Fac.	.00	x	0	
	KUR/Kyoto University Research Reactor	Kumatori-cho	Pool	1.00	x	2	
	JMTR-CA/Japan Material Testing Reactor Critical Facility	Tokai-mura	Crit. Fac.	.00	x	2	
	FCA/Fast Critical Assembly	Tokai-mura	Crit. Fac.	.00	x	5	
	JMTR/Japan Mitsubishi Critical Facility	Orai Ohmiya-Saitama	Tank Tank	50.00 .00	x	3	
	Deuterium Critical Assembly	Orai-Ibarachi	Tank	.00			
	Korea, Republic of	TRIGA II/Seoul	Seoul	Triga II	.10	x	0
	Mexico	National Institute of Nuclear Energy Reactor	Mexico City	Triga III	1.00		0
	Pakistan	PRR/Pakistan Research Reactor	Rawalpindi	Pool	5.00	x	2
Philippines	PRR-1/Philippine Research Reactor	Diliman	Pool	1.00	x	1	
Portugal	RPI/Portuguese Research Reactor	Sacavem	Pool	1.00	x	1	
South Africa	SAFARI-I	Pelindaba	Tank	20.00	x	5	
	Critical Assembly	Pelindaba	Crit. Fac.	.00	x	1	
Spain	ARBI	Bilbao	Argonaut	.01	x	0	
	ARGOS	Barcelona	Argonaut	.01	x	0	
	CORAL I	Madrid	Zero energy fast reactor	.00		5	
	JEN I	Madrid	Pool	3.00	x)	1	
	JEN II	Madrid	Pool	.00	x)		
Thailand	TRR-1/Thai Research Reactor 1	Bangkok	Pool	1.00	x	1	
Turkey	TR-1	Istanbul	Pool	1.00	x	1	
United Kingdom	ZEBRA/Fast Critical Assembly	Winfrith	Crit. Fac.	.00	x	A	
United States	BGRR/Brookhaven Graphite Research Reactor	Long Island (N. Y.)	Graph. Mod.	20.00	x	A	
	BMRR/Brookhaven Medical Research Reactor	Long Island (N. Y.)	Tank	3.00	x	1	
Uruguay	URR/Uruguay Research Reactor	Montevideo	Lockheed	.10		0	
Venezuela	RV-1	Caracas	Pool	3.00	x	0	
Viet-Nam	VNR-1/Viet-Nam Research Reactor 1	Dalat	Triga II	.25	x	0	
Yugoslavia	TRIGA II/Yugoslav Research Reactor	Ljubljana	Triga II	.25	x	0	

B. Nuclear power stations

Member State	Name of power station	Location	Type	Capacity MW(e)	In opera- tion	Maximum routine inspections per year <sup>c/</sup>
(India)	(Tarapur Atomic Power Station)	Tarapur	BWR	380	x	A
Japan	Tokai-mura Nuclear Power Station	Tokai-mura	Magnox	185	x	A
	Tsuruga Nuclear Power Station	Tsuruga	BWR	320	x	A
	Mihama Nuclear Power Station	Mihama-Fukui	PWR	340		A
	Fukushima Nuclear Power Station	Ohkumo- Fukushima	BWR	460		A
Pakistan	Karachi Nuclear Power Project	Karachi	Candu	137		A
Spain	José Cabrera Nuclear Power Station	Almonacid de Zorita	PWR	156	x	A
	Santa Maria de Garona Nuclear Power Station	Santander	BWR	450		A
United Kingdom	Bradwell Nuclear Power Station	Bradwell	Magnox	300	x	A
United States	Yankee Nuclear Power Station	Rowe (Mass.)	PWR	180	x	A

C. Conversion plants, fabrication plants and chemical reprocessing plants

Pilot Fuel Reprocessing Plant, Ezeiza, Argentina

Pilot Fuel Fabrication Plant, Constituyentes, Argentina

Pilot Reprocessing Plant, Juan Vigon Centre, Madrid, Spain

Nuclear Fuel Services Incorporated, West Valley, New York, USA

<sup>a/</sup> Where Member State and/or name of reactor are given in brackets, the agreement is not yet in force.

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

<sup>c/</sup> A = Access at all times.

Table 24

## Contracts for safeguards research and development

Duration of contract	Title	Institute	Agency contribution in dollars
1969-70	Determination of the accumulation of transuranium elements in spent fuel elements from the First Atomic Power Station	Institute of Physics and Power Engineering, Obninsk, Soviet Union	nil
1969-70	Development of safeguards procedures for a reprocessing plant with mechanical head-end and mixer settler contactors using a Purex flow sheet	Power Reactor and Nuclear Fuel Development Corporation, Reprocessing Division, Tokyo	6 000
1969-71	Feasibility study of safeguards systems for a plutonium fuel development facility	Power Reactor and Nuclear Fuel Development Corporation, Plutonium Fuels Division, Tokyo	6 000
1969-70	Feasibility study of accounting and monitoring spent Magnox fuel elements discharged to pool storage and shipping system by use of automatic instrumentation	Japan Atomic Power Co., Fuel Section, Tokyo	6 000
1969-70	Development of safeguards procedures for an ALKEM type plant fabricating plutonium fuel elements for fast breeder reactors	Institut für Angewandte Reaktorphysik, Kernforschungszentrum, Karlsruhe, Federal Republic of Germany	10 000
1969-70	The examination of possible design criteria which will facilitate the application of safeguards	United Kingdom Atomic Energy Authority, Production Group, United Kingdom	5 000
1969-70	High precision coulometric determination of plutonium in dioxide products	Vernadsky Institute Moscow	nil
1969-70	Express method of plutonium separation from commercial plant solutions for measurement of its specific alpha-activity and for alpha and mass spectrometric measurement of its isotopic composition	Vernadsky Institute Moscow	nil
1970-71	Safeguards Development of José Cabrera Nuclear Power Station	Junta de Energía Nuclear and "José Cabrera" Nuclear Power Station, Spain	7 500

Duration of contract	Title	Institute	Agency contribution in dollars
1969-70	Investigation and verification of reactor burn-up calculations by measurement in a reprocessing plant	Eurochemic Mol, Belgium	10 000
1969-70	Investigation of reprocessing input measurement using tracer technique	Eurochemic Mol, Belgium	10 000
1970-71	Study of MUF values calculated over three balance areas and the plant as a whole during a reprocessing run for highly enriched uranium fuel	Eurochemic Mol, Belgium	3 100
1969-70	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 Moscow	12 500
1969-70	Analysis of uranium burn-up and plutonium build-up in fast reactors	Institute of Physics and Energetics, Obninsk, Soviet Union	20 000
1969-70	Analysis of the safeguards capabilities of material balance accounting systems in selected uranium and plutonium scrap processing	Nuclear Audit and Testing Company, Division of Ledoux and Co., Washington, D. C., United States	7 700

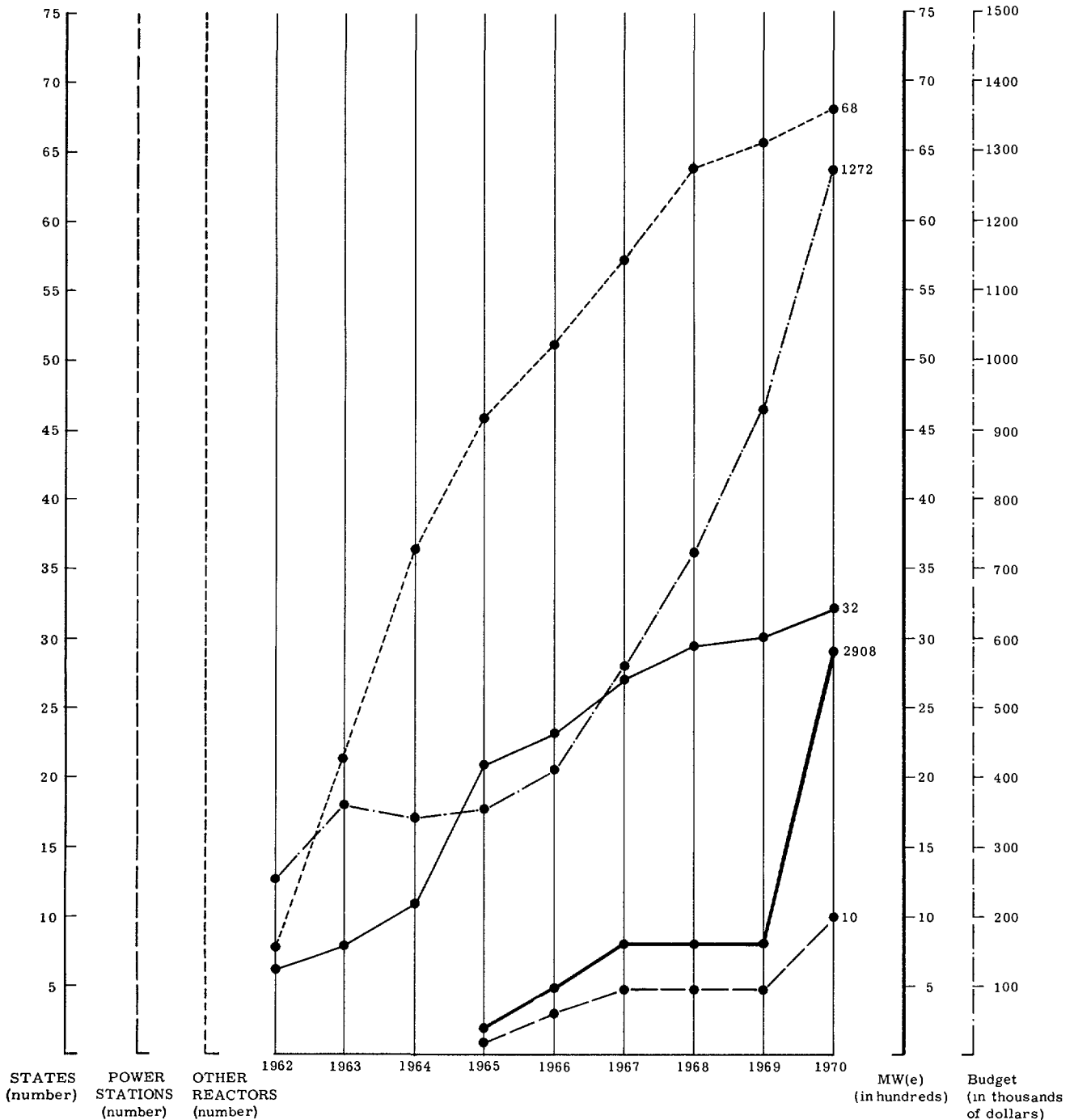
# GROWTH OF AGENCY SAFEGUARDS

LEGEND

- Number of States with safeguards agreements <sup>a/</sup>
- Number of nuclear power stations under safeguards <sup>a/b/</sup>
- MW(e) of nuclear power stations under safeguards
- Number of reactors other than power reactors under safeguards <sup>a/b/</sup>
- Budgeted cost of safeguards

<sup>a/</sup> all data relate to safeguards agreements approved by the Board up to 30 June of the indicated year

<sup>b/</sup> Data relate to reactors under construction or operational



## ADMINISTRATION

## EXTERNAL RELATIONS

116. The debate on the Agency's report to the General Assembly for 1968-69, which was presented by the Director General on 11 December 1969, showed that most of the delegations that took part considered that the Agency was the appropriate body for carrying out control functions on the entry into force of NPT, and for following up the recommendations of the Conference of Non-Nuclear-Weapon States including those relating to nuclear explosions for peaceful purposes. The Agency has continued to co-operate closely with the United Nations in these matters and will contribute to the reports called for by General Assembly Resolutions 2605 A and B (XXIV).

117. In April 1970 the United Nations Scientific Advisory Committee met at the Agency's Headquarters, and drew up the draft agenda for the Fourth International Conference on the Peaceful Uses of Atomic Energy, to be held in 1971 in Geneva.

118. At the invitation of the Director General ACC held its fiftieth session at the Agency's Headquarters in April 1970. The Secretary-General of the United Nations presided over the session, and the executive heads of most of the specialized agencies attended it.

119. In September 1969 working arrangements were agreed to by the Secretariats of the Agency and of UNIDO for co-operation in the main fields of mutual interest, especially in subjects where radiation technology can serve the industries of developing countries.

120. The agreement between the Agency and UNESCO providing for the joint operation of the International Centre for Theoretical Physics at Trieste for a period of five years was effective from 1 January 1970. The two organizations will make equal financial contributions to the costs of operating the Centre. The contribution of the Italian Government under its agreement with the Agency remains unchanged.

121. Routine co-operation with other specialized agencies and with intergovernmental organizations is referred to in the sections on the technical programme activities.

## PERSONNEL

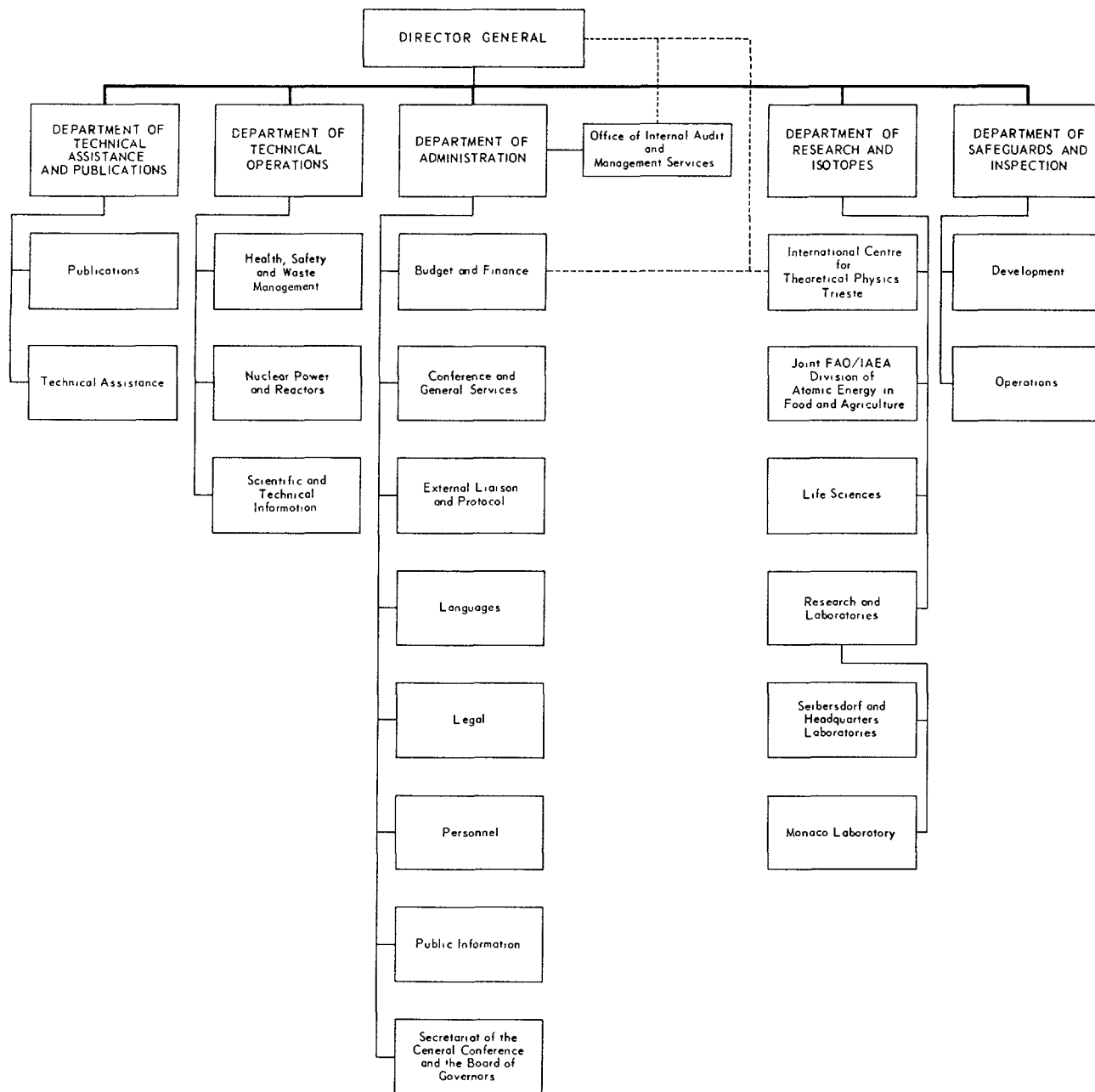
122. On 30 June 1970 the Secretariat had 354 staff members in the Professional category and above. Of these, 347 held permanent or fixed-term contracts, six were serving under Special Service Agreements and one was seconded to another United Nations organization. There were 339 such staff members employed at the Agency's Headquarters, four at Trieste, six at Monaco, two at New York, two at Geneva and one in Bangkok. The number of staff members holding posts that were subject to geographical distribution was 290; 55 Member States were represented on the staff, one staff member was stateless. The Secretariat also included 527 General Service staff, 12 of whom were serving in Monaco, 17 at Trieste, two at New York, one at Geneva and one was seconded to another United Nations organization. The total strength of the staff was thus 1081 [25].

123. The following organization chart shows the structure of the Secretariat as at 30 June 1970.

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[25] Details of the Agency's staff are to be found in document INFCIRC/22/Rev.10, the Annex to which contains statistical information on staff members who held posts that were subject to geographical distribution.

## Organizational Chart



## FINANCE

Regular Budget

The financial year 1969

124. The assessment of contributions on Member States included in the scale of assessment for 1969 amounted to \$10 887 500. Additional assessments on Liechtenstein, which joined the Agency in 1968 after the scale for 1969 had been established, and three new Members (Malaysia, Niger and Zambia) which joined in 1969, increased the total by \$23 953 to \$10 911 453.

125. By 31 December 1969, the Agency received contributions towards the Regular Budget for 1969 amounting to \$9 637 651, which represents 88.33% of the total assessed for that appropriation. By 30 June 1970 \$10 249 786 or 93.93% of the 1969 Regular Budget assessment had been received.

126. The Agency's obligations for 1969 amounted to \$11 234 761, which resulted in budgetary savings of \$16 239 from the appropriations for 1969. A further amount of \$58 434 from miscellaneous income brought the total budgetary surplus at 31 December 1969 to \$74 673 as follows:

Budgetary savings		\$16 239
Contributions assessed on new Member States		23 953
Excess of miscellaneous income over budget:		
Actual miscellaneous income	\$397 981	
Less: budget	363 500	34 481
		<hr/>
Budgetary surplus for 1969		\$74 673
		<hr/>

Since contributions in the amount of \$1 273 802 were outstanding from Member States for 1969, there was a provisional cash deficit of \$1 199 129.

127. Unliquidated obligations in respect of 1969 appropriations at 31 December 1969 were \$1 042 732, of which \$450 853 had been liquidated by 30 June 1970.

128. Savings under six appropriation sections totalling \$82 565 were transferred to Sections 6 - Salaries and wages and 7 - Common staff costs, in order partially to cover unforeseen increases in emoluments of staff and costs of supplies, services and equipment. To cover the balance of these increases it was also necessary to transfer \$113 762 from Section 12 - Contingent extraordinary expenditures.

The financial year 1970

129. By 30 June 1970 the following advances to the Working Capital Fund and contributions to the Regular Budget for 1970 had been received:

Advances to the Working Capital Fund	\$2 001 400
Contributions to the Regular Budget for 1970	\$4 811 613

By that date Member States had thus paid 99.92% of the total advances due to the Working Capital Fund and 40.53% of the total contributions due to the 1970 Regular Budget.

Operational Budget

130. Although the General Conference at its twelfth (1968) regular session again established a target of \$2 million for voluntary contributions in 1969, there was a



shortfall of approximately \$507 181 in the actual pledges made by Member States. Of a total amount of \$1 492 819 pledged to the General Fund for 1969, \$896 853 had been paid by 31 December 1969. By 30 June 1970 receipts amounted to \$981 853, leaving a balance of \$510 966 still to be paid.

131. The total operational obligations incurred during 1969 amounted to \$3 236 361. Unliquidated obligations as at 31 December 1969 including obligations brought forward from the previous years, amounted to \$907 841.

The Agency's resources in 1969

132. Resources equivalent to more than \$16 500 000 were at the Agency's disposal during 1969 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 set out in Table 25.

Table 25

Summary of resources received for use during 1969<sup>a/</sup>

	\$	\$	\$
<u>Administrative Fund</u>			
Assessed contributions to the Regular Budget			
Member States included in the scale for 1969	10 887 500		
New Members	<u>23 953</u>	10 911 453	
Actual miscellaneous income		<u>397 981</u>	
Sub-total			11 309 434
<u>General Fund (including Operating Fund I and II)</u>			
Voluntary contributions pledged for 1969		1 492 819	
Net increase in voluntary contributions pledged for 1968		57 339	
Miscellaneous income (from investments, laboratory, local costs, etc.)		371 590	
Special voluntary contributions pledged		<u>289 640</u>	
Sub-total			2 211 388
<u>Special Accounts</u>			
Central Fund in Trust Technical Assistance Programme to the Democratic Republic of the Congo			17 833
Swedish International Development Authority Trust Fund			68 120
<u>United Nations Development Programme</u>			
<u>Technical Assistance Account<sup>b/</sup></u>			
Funds allocated in 1969 and miscellaneous income			2 067 533
<u>Special Fund<sup>c/</sup></u>			
Funds allocated in 1969 and miscellaneous income			(19 050)
Executing Agency Overhead Costs			99 900
<u>Financial contributions received towards the costs of conferences, symposia and seminars for 1969</u>			
Amounts pledged			41 256
<u>Contributions in services and in kind<sup>d/</sup></u>			
Type II fellowships awarded <sup>e/</sup>		523 400	
Technical assistance equipment and supplies		82 232	
Laboratory equipment and supplies		53 000	
Library, etc.		7 987	
Special nuclear materials		<u>50 000</u>	
Sub-total			<u>716 619</u>
TOTAL			<u><u>16 513 033</u></u>

a/ See the Agency's accounts for 1969 (GC(XIV)/435).

b/ Ibid., Statement IX, A.

c/ Ibid., Statement X, A and X, B.

d/ Ibid., Schedule G. In addition to monetary funds, contributions in services and kind were at the Agency's disposal. Not listed since not evaluable in dollars are cost-free experts: 90 experts - 571 man/days in 1969.

e/ Ibid., Schedule G. The amount shown represents the total value of fellowships offered during the respective year, while many of the fellowships extended over a number of years.

## LEGAL MATTERS

133. A Supplemental Agreement to the Headquarters Agreement [26] was signed on 4 June 1970. It extends to the Agency those terms of the UNIDO Headquarters Agreement of 13 April 1967 that are more favourable to UNIDO than the corresponding provisions of the Agency's Headquarters Agreement.

134. By 30 June 1970 the Agreement on the Privileges and Immunities of the Agency [27] had been accepted by 35 Member States.

135. Recommendations for solving problems of nuclear insurance were drawn up by a panel of experts, which was convened in November 1969.

136. Recent trends in the development of nuclear law were considered at a seminar held in April 1970 in Bangkok, which was attended by 16 participants from 11 Member States in South Asia, South East Asia and the Pacific and the Far East.

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[26] INFCIRC/15, Part I.

[27] INFCIRC/9/Rev. 2.

A N N E X A  
THE BOARD OF GOVERNORS

To 29 September 1969	1969-1970	From 29 September 1969
Algeria <sup>a/</sup>	Argentina <sup>b/</sup>	
	Australia <sup>c/ d/</sup>	
Belgium <sup>e/</sup>	Brazil <sup>c/ d/</sup>	
Bulgaria <sup>a/</sup>	Canada <sup>c/ d/</sup>	
Ceylon <sup>a/</sup>		Czechoslovak Socialist Republic <sup>f/</sup>
Finland <sup>e/</sup>	France <sup>c/ d/</sup>	
	India <sup>c/ d/</sup>	Hungary <sup>g/</sup>
	Iran <sup>b/</sup>	
	Italy <sup>b/</sup>	
	Japan <sup>c/ d/</sup>	
Madagascar <sup>a/</sup>		Morocco <sup>g/</sup>
		Nigeria <sup>g/</sup>
		Pakistan <sup>g/</sup>
Peru <sup>a/</sup>		
Philippines <sup>a/</sup>		
Poland <sup>e/</sup>		Portugal <sup>f/</sup>
	Singapore <sup>b/</sup>	
	South Africa <sup>c/ d/</sup>	
		Spain <sup>g/</sup>
		Sweden <sup>f/</sup>
Turkey <sup>a/</sup>	Union of Soviet Socialist Republics <sup>c/ d/</sup>	
	United Kingdom of Great Britain and Northern Ireland <sup>c/ d/</sup>	
	United States of America <sup>c/ d/</sup>	
		Uruguay <sup>g/</sup>
	Venezuela <sup>b/</sup>	
		Viet-Nam <sup>g/</sup>

- a/ Elected by the General Conference on 2 October 1967 under Article VI. A. 3 of the Statute.
- b/ Elected by the General Conference on 30 September 1968 under Article VI. A. 3 of the Statute.
- c/ Designated by the Board on 13 June 1968 under Article VI. A. 1 of the Statute.
- d/ Designated by the Board on 11 June 1969 under Article VI. A. 1 of the Statute.
- e/ Designated by the Board on 13 June 1968 under Article VI. A. 2 of the Statute.
- f/ Designated by the Board on 11 June 1969 under Article VI. A. 2 of the Statute.
- g/ Elected by the General Conference on 29 September 1969 under Article VI. A. 3 of the Statute.

## ANNEX B

## FELLOWSHIPS OFFERED OR PROVIDED FREE OF CHARGE IN 1969

Donor	Number of fellowships	
	Offered	Utilized <sup>a/</sup>
<u>Member States</u>		
Argentina	5	4
Austria	3 <sup>b/</sup>	2
Belgium	6	5
Brazil	10	-
China	2	-
Czechoslovak Socialist Republic	9	1
Denmark	5	5
Germany, Federal Republic of	- <sup>c/</sup>	25
Hungary	4	1
India	10	7
Israel	5 <sup>d/</sup>	1
Italy	20 <sup>e/</sup>	17
Japan	10	6 <sup>f/</sup>
Mexico	2	2
Netherlands	8	6
Poland	5	1
Romania	- <sup>g/</sup>	-
Spain	5	5
Sweden	4	5
Switzerland	2	-
Tunisia	2	-
Union of Soviet Socialist Republics	- <sup>h/</sup>	8
United States of America	40	43 <sup>i/</sup>
Yugoslavia	5 <sup>j/</sup>	1
	Sub-total	162
<u>Regional organizations</u>		
Joint Institute for Nuclear Research at Dubna, Soviet Union	3 <sup>k/</sup>	1
	Total	165
		146

<sup>a/</sup> Number of awards less rejections and withdrawals.

<sup>b/</sup> On the basis of nine man-months per fellowship; the offer was for a total of 27 man-months.

<sup>c/</sup> No maximum number of openings was specified in the Government's offer.

<sup>d/</sup> On the basis of nine man-months per fellowship; the offer was for a total of 45 man-months.

<sup>e/</sup> On the basis of eight man-months per fellowship; the offer was for a total of 160 man-months.

<sup>f/</sup> Two of these awards utilized fellowships available under the Government's 1968 offer. The remaining six openings will be used for 1970 awards.

- g/ Twelve openings were available in 1969, as a carry-over from the offer made in 1965.
- h/ The resources available consisted of savings from prior years and the funds remaining from the Government's 1967 offer, which was for a specified amount of money rather than a given number of openings or man-months of training.
- i/ Includes awards financed out of current and prior years' savings.
- j/ On the basis of six man-months per fellowship; the offer was for a total of 30 man-months.
- k/ On the basis of 12 man-months per fellowship; the offer was for a total of 36 man-months.

## ANNEX C

## RESEARCH CONTRACTS

I. Total value of contracts in 1969

Year	New contracts	Renewals	Total	Value
1969	85	111	196	786 795

II. Analysis by subject matter of contracts awarded or renewed in 1969

Subject matter of research	Number of contracts placed	Number of contracts renewed	Agency contribution in dollars
Nuclear technology			
Nuclear power and reactors	4	6	38 300
Waste treatment	2	4	28 650
Physics and chemistry	3	7	47 410
Radioisotope and radiation applications in			
Agriculture	27	54	278 815
Food technology	4	5	37 000
Industry	2	1	14 000
Medicine	19	11	147 860
Water resources development	5	2	37 400
Protection of man against ionizing radiations			
Health physics and radiation protection	5	4	34 760
Radiation biology	11	14	78 800
Environmental contamination and waste disposal	3	3	43 800
Total	85	111	786 795



III. Analysis by country of contracts awarded or renewed in 1969

Country	Number of contracts placed	Number of contracts renewed	Agency contribution in dollars
Argentina	4	3	31 300
Australia	-	1	3 000
Austria	1	1	4 000
Belgium	3	2	18 000
Brazil	1	2	13 350
Bulgaria	-	3	15 100
Ceylon	1	2	8 900
Chile	3	3	32 500
China	3	6	33 400
Colombia	-	1	4 000
Cuba	1	-	3 350
Czechoslovak Socialist Republic	1	1	6 500
Ecuador	-	2	8 300
El Salvador	1	1	7 500
Ethiopia	-	1	6 000
Finland	-	2	12 500
France	1	1	7 100
Germany, Federal Republic of	2	1	10 000
Ghana	-	1	3 000
Greece	1	3	13 000
Hungary	3	4	23 850
India	4	3	20 800
Indonesia	1	1	5 960
Iran	2	1	8 650
Iraq	1	1	5 600
Israel	-	5	25 200
Italy	-	1	4 300
Japan	2	1	8 000
Kenya	-	3	11 000
Korea, Republic of	4	4	26 370
Lebanon	1	2	11 830
Madagascar	-	1	2 500
Mexico	2	1	17 735
Morocco	-	1	3 600
Netherlands	2	-	7 000
Nigeria	3	1	19 830
Norway	-	1	9 700
Pakistan	5	9	41 830
Peru	-	1	5 120
Philippines	1	3	15 500
Poland	-	1	7 000
Portugal	-	2	11 000
Romania	2	6	27 890
Senegal	1	-	7 000
Singapore	1	-	3 000
South Africa	1	1	3 400
Spain	3	3	40 000
Sudan	1	-	3 500

Country	Number of contracts placed	Number of contracts renewed	Agency contribution in dollars
Sweden	1	-	4 000
Switzerland	1	-	2 000
Thailand	4	5	31 650
Turkey	2	1	9 450
Uganda	2	-	7 700
Union of Soviet Socialist Republics	2	-	22 000
United Arab Republic	2	4	31 170
United Kingdom of Great Britain and Northern Ireland	-	1	3 800
United States of America	2	-	5 000
Uruguay	2	-	11 800
Viet-Nam	1	1	7 400
Yugoslavia	2	5	29 860
Zambia	1	-	3 000
Total	85	111	786 795

## ANNEX D

CONFERENCES, SYMPOSIA AND SEMINARS HELD  
DURING THE PERIOD 1 JULY 1969-30 JUNE 1970

Date and place	Title	Co-sponsoring organizations	Number of participants	Number of countries represented	Number of organizations represented	Number of papers presented
<u>1969</u>						
14-18 July Pullman, Washington	Symposium on the Nature, Induction and Utilization of Mutations in Plants	FAO	101	25	1	58
28 July- 1 August Vienna	Second Symposium on the Physics and Chemistry of fission		238	28	6	55
18-22 August Munich	Symposium on Utilization of Large Radiation Sources and Accelerators in Industrial Processing		186	29	5	50
8-12 September Vienna	Symposium on "In Vitro" Procedures with Radioisotopes in Clinical Medicine and Research	WHO	191	32	3	50
13-17 October Saclay (France)	Symposium on Radiation Safety Problems in the Design and Operation of "Hot" Facilities		174	26	5	60
20-24 October Istanbul	Symposium on Nuclear Energy Costs and Economic Development		165	39	6	54
10-14 November Prague	Symposium on the Performance of Nuclear Power Reactor Components		215	27	4	39
<u>1970</u>						
16-20 February Vienna	Symposium on the Handling of Nuclear Information		168	31	12	57
9-13 March Vienna	Symposium on the Use of Isotopes in Hydrology		221	44	7	54
23-27 March Monaco	Symposium on Progress in Sodium-Cooled Fast Reactor Engineering		273	23	6	52
6-11 April Bangkok	Seminar on the Development of Nuclear Law		24	11	-	17
8-12 June Vienna	Symposium on Plant Protein Resources: Their Improvement through the Application of Nuclear Techniques	FAO	106	33	6	44
15-19 June Helsinki	Second International Conference on Nuclear Data for Reactors		163	28	3	120

## ANNEX E

## STATUS OF FINANCIAL CONTRIBUTIONS TO THE AGENCY ON 30 JUNE 1970

## 1. Advances to the Working Capital Fund and contributions to the Regular Budget for 1970

(In United States dollars)

Member State	Working Capital Fund			Regular Budget for 1970			
	Assessed	Paid	Outstanding	Assessed	Credits	Paid	Outstanding
Afghanistan	800	800	-	4 741	-	-	4 741
Albania	800	800	-	4 741	55	-	4 686
Algeria	1 800	1 800	-	10 668	150	-	10 518
Argentina	16 800	16 800	-	99 565	1 557	15 524	82 484
Australia	27 600	27 600	-	163 571	2 664	80 453	80 454
Austria	10 400	10 400	-	61 635	901	60 734	-
Belgium	20 000	20 000	-	118 530	1 932	116 598	-
Bolivia	800	800	-	4 741	-	-	4 741
Brazil	16 200	16 200	-	96 009	-	-	96 009
Bulgaria	3 200	3 200	-	18 964	-	-	18 964
Burma	1 000	1 000	-	5 926	94	-	5 832
Byelorussian Soviet Socialist Republic	9 200	9 200	-	54 523	882	26 800	26 841
Cambodia	800	800	-	4 741	-	-	4 741
Cameroon	800	800	-	4 741	75	4 666	-
Canada	54 800	54 800	-	324 772	5 347	319 425	-
Ceylon	1 000	1 000	-	5 926	131	5 795	-
Chile	4 200	4 200	-	24 891	-	-	24 891
China	72 600	72 600	-	430 264	-	-	430 264
Colombia	3 600	3 600	-	21 335	394	-	20 941
Congo, Democratic Republic of the	1 000	1 000	-	5 926	218	-	5 708
Costa Rica	800	800	-	4 741	-	-	4 741
Cuba	3 400	3 400	-	20 150	-	-	20 150
Cyprus	800	800	-	4 741	75	4 666	-
Czechoslovak Socialist Republic	16 600	16 600	-	98 380	2 076	-	96 304
Denmark	11 200	11 200	-	66 376	1 051	65 325	-
Dominican Republic	800	800	-	4 741	-	-	4 741
Ecuador	800	800	-	4 741	-	-	4 741
El Salvador	800	800	-	4 741	-	-	4 741
Ethiopia	800	800	-	4 741	-	-	4 741
Finland	8 800	8 800	-	52 153	932	51 221	-
France	108 800	108 800	-	644 803	10 481	634 322	-
Gabon	800	800	-	4 741	-	-	4 741
Germany, Federal Republic of	127 200	127 200	-	753 850	12 714	370 568	370 568
Ghana	1 400	1 400	-	8 297	131	8 166	-
Greece	5 200	5 200	-	30 817	432	-	30 385
Guatemala	1 000	1 000	-	5 926	-	-	5 926
Haiti	800	800	-	4 741	-	-	4 741
Holy See	800	800	-	4 741	75	4 666	-
Hungary	9 400	9 400	-	55 709	-	-	55 709
Iceland	800	800	-	4 741	75	4 666	-
India	31 600	31 600	-	187 277	3 133	184 144	-
Indonesia	6 200	6 200	-	36 774	657	35 786	331
Iran	4 000	4 000	-	23 706	-	-	23 706
Iraq	1 200	1 200	-	7 111	131	6 980	-
Israel	3 600	3 600	-	21 335	281	21 054	-
Italy	58 800	58 800	-	348 478	4 296	344 182	-
Ivory Coast	800	800	-	4 741	75	4 666	-
Jamaica	1 000	1 000	-	5 926	94	5 832	-
Japan	68 600	68 600	-	406 558	4 672	401 886	-
Jordan	800	800	-	4 741	75	4 666	-
Kenya	800	800	-	4 741	75	4 666	-
Korea, Republic of	2 200	2 200	-	13 038	225	-	12 813

Member State	Working Capital Fund			Regular Budget for 1970			
	Assessed	Paid	Outstanding	Assessed	Credits	Paid	Outstanding
Kuwait	1 200	1 200	-	7 111	-	7 111	-
Lebanon	1 000	1 000	-	5 926	94	-	5 832
Liberia	800	800	-	4 741	-	-	4 741
Libyan Arab Republic	800	800	-	4 741	-	-	4 741
Liechtenstein	800	800	-	4 741	-	-	4 741
Luxembourg	1 000	1 000	-	5 926	94	5 500	332
Madagascar	800	800	-	4 741	75	4 666	-
Malaysia	2 000	2 000	-	11 853	492	11 361	-
Mali	800	800	-	4 741	-	-	4 741
Mexico	15 800	15 800	-	93 638	-	-	93 638
Monaco	800	800	-	4 741	75	4 666	-
Morocco	1 800	1 800	-	10 667	122	10 545	-
Netherlands	21 000	21 000	-	124 456	1 876	42 580	80 000
New Zealand	6 600	6 600	-	39 115	638	38 477	-
Nicaragua	800	800	-	4 741	-	-	4 741
Niger	800	800	-	4 741	-	4 727	14
Nigeria	2 600	2 600	-	15 409	281	1 999	13 129
Norway	7 800	7 800	-	46 226	750	45 476	-
Pakistan	6 600	6 600	-	39 115	819	19 148	19 148
Panama	800	800	-	4 741	-	-	4 741
Paraguay	800	-	800	4 741	-	-	4 741
Peru	1 800	1 800	-	10 667	-	-	10 667
Philippines	6 200	6 200	-	36 744	582	-	36 162
Poland	26 600	26 600	-	157 645	2 658	58 144	96 843
Portugal	2 800	2 800	-	16 594	463	16 131	-
Romania	6 600	6 600	-	39 115	582	19 267	19 266
Saudi Arabia	1 000	1 000	-	5 926	113	5 813	-
Senegal	800	800	-	4 741	-	-	4 741
Sierra Leone	800	800	-	4 741	-	-	4 741
Singapore	1 000	1 000	-	5 926	75	5 851	-
South Africa	9 400	9 400	-	55 709	882	54 827	-
Spain	16 600	16 600	-	98 380	-	9 545	88 835
Sudan	1 000	1 000	-	5 926	-	-	5 926
Sweden	22 600	22 600	-	133 939	2 320	131 619	-
Switzerland	15 600	15 600	-	92 453	1 482	90 971	-
Syrian Arab Republic	800	800	-	4 741	94	-	4 647
Thailand	2 400	2 400	-	14 223	244	13 979	-
Tunisia	800	800	-	4 741	-	-	4 741
Turkey	6 400	6 400	-	37 929	582	37 347	-
Uganda	800	800	-	4 741	75	-	4 666
Ukrainian Soviet Socialist Republic	35 000	35 000	-	207 427	3 321	102 000	102 106
Union of Soviet Socialist Republics	265 000	265 000	-	1 570 522	25 797	772 300	772 425
United Arab Republic	3 600	3 600	-	21 335	-	-	21 335
United Kingdom of Great Britain and Northern Ireland	120 000	120 000	-	711 180	12 576	349 302	349 302
United States of America	630 000	630 000	-	3 733 695	-	-	3 733 695
Uruguay	1 600	1 600	-	9 482	-	-	9 482
Venezuela	8 200	8 200	-	48 597	-	844	47 753
Viet-Nam	1 200	1 200	-	7 111	131	6 980	-
Yugoslavia	7 200	7 200	-	42 670	716	21 035	20 919
Zambia	800	-	800	4 741	-	-	4 741
Sub-total	2 000 000	1 998 400	1 600	11 853 000	114 165	4 679 668	7 059 167
Ireland (New Member: 6 Jan. 1970)	3 000	3 000	-	17 780	-	17 780	-
TOTAL	2 003 000	2 001 400	1 600	11 870 780	114 165	4 697 448	7 059 167

2. Outstanding contributions to the Regular Budgets for the years 1958-1969  
(In United States dollars)

	1958/61	1962	1963	1964	1965	1966 <sup>a/</sup>	1967	1968	1969	Total
Afghanistan	-	-	-	3 343	3 857	4 333	4 587	5 082	4 155	25 357
Bolivia	-	-	-	-	-	2 954	3 670	4 040	4 355	15 019
Brazil	-	-	-	-	-	-	-	-	31 236	31 236
Bulgaria	-	-	-	-	-	-	-	-	244	244
Cambodia	-	-	-	-	-	96	3 532	4 040	4 283	11 951
Chile	-	-	-	-	-	-	-	-	21 384	21 384
China	-	-	-	-	-	-	-	385 070	385 846	770 916
Costa Rica	-	-	-	-	-	-	-	176	4 283	4 459
Cuba	-	-	-	-	-	-	-	16 829	18 309	35 138
Dominican Republic	-	3 015	3 561	3 610	3 857	3 467	3 670	4 065	4 355	29 600
Ecuador	-	-	-	-	-	-	273	5 082	4 155	9 510
El Salvador	-	-	-	-	-	96	3 532	4 040	4 283	11 951
Ethiopia	-	-	-	-	-	-	-	-	4 176	4 176
Gabon	-	-	-	-	-	-	-	-	513	513
Guatemala	-	-	-	-	-	1 681	3 670	4 065	5 444	14 860
Haiti	6 925 <sup>b/</sup>	2 652	2 849	2 888	3 085	3 467	3 670	4 065	4 355	33 856
Honduras <sup>c/</sup>	-	-	-	2 020	3 085	3 467	3 670	-	-	12 242
Hungary	-	-	-	-	-	-	-	20 893	49 676	70 569
Iran	-	-	-	-	-	-	-	-	18 903	18 903
Liberia	-	-	-	-	-	21	-	4 040	4 283	8 344
Libyan Arab Republic	-	-	-	-	-	-	-	-	4 208	4 208
Mali	-	-	-	-	-	-	2 322	4 065	4 355	10 742
Mexico	-	-	-	-	-	-	-	-	8 540	8 540
Nicaragua	-	-	-	-	-	-	-	-	3 808	3 808
Panama	-	-	-	-	-	-	-	-	4 208	4 208
Paraguay	8 530 <sup>d/</sup>	2 652	2 849	2 888	3 085	3 467	3 670	4 065	4 355	35 561
Peru	-	-	-	-	-	-	-	5 430	9 799	15 229
Senegal	-	-	-	-	-	-	-	3 259	4 283	7 542
Sierra Leone	-	-	-	-	-	-	-	624	4 355	4 979
Sudan	-	-	-	-	-	26	-	5 044	5 355	10 425
Tunisia	-	-	-	-	-	-	-	-	200	200
United Arab Republic	-	-	-	-	-	-	-	2 685	18 621	21 306
United States of America	-	-	-	-	-	-	-	-	2 807	2 807
Uruguay	-	-	-	-	-	-	-	-	8 180	8 180
Zambia	-	-	-	-	-	-	-	-	4 355	4 355
<b>Total outstanding</b>	<b>15 355</b>	<b>8 319</b>	<b>9 259</b>	<b>14 749</b>	<b>16 969</b>	<b>23 075</b>	<b>36 266</b>	<b>486 659</b>	<b>661 667</b>	<b>1 272 318</b>
<b>Total paid</b>	<b>21 406 075</b>	<b>6 631 760</b>	<b>7 146 004</b>	<b>7 215 525</b>	<b>7 715 313</b>	<b>8 654 484</b>	<b>9 148 744</b>	<b>9 684 971</b>	<b>10 249 786</b>	<b>87 852 662</b>
<b>Total assessments</b>	<b>21 421 430</b>	<b>6 640 079</b>	<b>7 155 263</b>	<b>7 230 274</b>	<b>7 732 282</b>	<b>8 677 559</b>	<b>9 185 010</b>	<b>10 171 630</b>	<b>10 911 453</b>	<b>89 124 980</b>
<b>Percentage of assessments paid</b>	<b>99.92</b>	<b>99.87</b>	<b>99.87</b>	<b>99.80</b>	<b>99.77</b>	<b>99.73</b>	<b>99.61</b>	<b>95.22</b>	<b>93.93</b>	<b>98.57</b>

a/ Includes supplementary assessment.

b/ Payable to the Regular Budgets as follows: \$2 021 for 1959; \$2 337 for 1960; and \$2 467 for 1961.

c/ Withdrew from membership on 19 June 1967.

d/ Payable to the Regular Budgets as follows: \$1 636 for 1958; \$2 090 for 1959; \$2 337 for 1960 and \$2 467 for 1961.

## 3. Voluntary contributions to the General Fund for 1969 and 1970

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

Member	1969			1970		
	Pledged	Paid	Outstanding	Pledged	Paid	Outstanding
Afghanistan	-	-	-	-	-	-
Albania	-	-	-	800 <sup>a/</sup>	-	800
Algeria	-	-	-	-	-	-
Argentina	16 800 <sup>a/</sup>	-	16 800	16 800 <sup>a/</sup>	-	16 800
Australia	28 400 <sup>a/</sup>	28 400	-	28 400 <sup>a/</sup>	28 400	-
Austria	10 400 <sup>a/</sup>	10 400	-	10 400 <sup>a/</sup>	10 400	-
Belgium	10 000	10 000	-	12 500	-	12 500
Bolivia	-	-	-	-	-	-
Brazil	16 200 <sup>a/</sup>	-	16 200	18 000 <sup>a/</sup>	-	18 000
Bulgaria	3 200 <sup>a/</sup>	3 200	-	3 200 <sup>a/</sup>	-	3 200
Burma	1 000 <sup>a/</sup>	-	1 000	1 000 <sup>a/</sup>	-	1 000
Byelorussian Soviet Socialist Republic	-	-	-	-	-	-
Cambodia	-	-	-	-	-	-
Cameroon	-	-	-	-	-	-
Canada	57 000 <sup>a/</sup>	57 000	-	57 000 <sup>a/</sup>	-	57 000
Ceylon	2 622 <sup>a/</sup>	2 622	-	-	-	-
Chile	-	-	-	-	-	-
China	10 000	10 000	-	10 000	-	10 000
Colombia	2 000	2 000	-	2 000	-	2 000
Congo, Democratic Republic of the	1 000 <sup>a/</sup>	1 000	-	1 000 <sup>a/</sup>	-	1 000
Costa Rica	-	-	-	800 <sup>a/</sup>	-	800
Cuba	-	-	-	-	-	-
Cyprus	800 <sup>a/</sup>	800	-	900 <sup>a/</sup>	-	900
Czechoslovak Socialist Republic	20 833 <sup>a/</sup>	20 833	-	20 833 <sup>a/</sup>	-	20 833
Denmark	11 200 <sup>a/</sup>	11 200	-	11 200 <sup>a/</sup>	11 200	-
Dominican Republic	-	-	-	-	-	-
Ecuador	-	-	-	-	-	-
El Salvador	-	-	-	-	-	-
Ethiopia	800 <sup>a/</sup>	800	-	800 <sup>a/</sup>	-	800
Finland	9 000	9 000	-	8 800	8 800	-
France	30 364	30 364	-	-	-	-
Gabon	-	-	-	-	-	-
Germany, Federal Republic of	127 400 <sup>a/</sup>	127 400	-	127 200 <sup>a/</sup>	63 600	63 600
Ghana	2 000 <sup>a/</sup>	2 000	-	2 000 <sup>a/</sup>	200	1 800
Greece	5 200 <sup>a/</sup>	5 200	-	5 200 <sup>a/</sup>	-	5 200
Guatemala	500	500	-	500	500	-
Haiti	-	-	-	800 <sup>a/</sup>	-	800
Holy See	2 000 <sup>a/</sup>	2 000	-	2 000 <sup>a/</sup>	2 000	-
Hungary	6 667	6 667	-	9 500 <sup>a/</sup>	9 500	-
Iceland	800 <sup>a/</sup>	800	-	800 <sup>a/</sup>	800	-
India	35 000 <sup>a/</sup>	35 000	-	35 000 <sup>a/</sup>	35 000	-
Indonesia	6 200	6 200	-	6 200 <sup>a/</sup>	-	6 200
Iran	3 600	-	3 600	3 600	-	3 600
Iraq	1 400 <sup>a/</sup>	1 400	-	1 200 <sup>a/</sup>	1 200	-
Ireland	-	-	-	3 000 <sup>a/</sup>	3 000	-
Israel	3 600 <sup>a/</sup>	3 600	-	3 600 <sup>a/</sup>	3 600	-
Italy	45 800	45 800	-	45 800	-	45 800
Ivory Coast	800	800	-	800 <sup>a/</sup>	800	-
Jamaica	-	-	-	-	-	-
Japan	60 000	60 000	-	68 600 <sup>a/</sup>	68 600	-
Jordan	-	-	-	800 <sup>a/</sup>	800	-
Kenya	-	-	-	-	-	-
Korea, Republic of	2 200 <sup>a/</sup>	2 200	-	2 200 <sup>a/</sup>	-	2 200
Kuwait	3 000 <sup>a/</sup>	3 000	-	-	-	-
Lebanon	-	-	-	1 000 <sup>a/</sup>	1 000	-
Liberia	-	-	-	-	-	-
Libyan Arab Republic	-	-	-	-	-	-
Liechtenstein	900 <sup>a/</sup>	900	-	1 000 <sup>a/</sup>	-	1 000

Member	1969			1970		
	Pledged	Paid	Outstanding	Pledged	Paid	Outstanding
Luxembourg	-	-	-	-	-	-
Madagascar	800 <sup>a/</sup>	800	-	800 <sup>a/</sup>	800	-
Malaysia	-	-	-	-	-	-
Mali	-	-	-	-	-	-
Mexico	14 700	14 700	-	-	-	-
Monaco	2 000 <sup>a/</sup>	2 000	-	2 000 <sup>a/</sup>	2 000	-
Morocco	2 000 <sup>a/</sup>	2 000	-	2 000 <sup>a/</sup>	2 000	-
Netherlands	21 000 <sup>a/</sup>	21 000	-	21 000 <sup>a/</sup>	-	21 000
New Zealand	6 600	6 600	-	6 600 <sup>a/</sup>	6 600	-
Nicaragua	-	-	-	-	-	-
Niger	-	-	-	800 <sup>a/</sup>	-	800
Nigeria	-	-	-	-	-	-
Norway	7 800 <sup>a/</sup>	7 800	-	7 800 <sup>a/</sup>	7 800	-
Pakistan	6 000	6 000	-	6 600 <sup>a/</sup>	6 600	-
Panama	-	-	-	-	-	-
Peru	1 800 <sup>a/</sup>	1 800	-	1 800 <sup>a/</sup>	1 500	300
Paraguay	-	-	-	-	-	-
Philippines	6 200 <sup>a/</sup>	6 200	-	6 200 <sup>a/</sup>	-	6 200
Poland	6 250	6 250	-	10 417	4 167	6 250
Portugal	3 600 <sup>a/</sup>	3 600	-	3 600 <sup>a/</sup>	3 600	-
Romania	8 250 <sup>a/</sup>	8 250	-	8 250 <sup>a/</sup>	8 250	-
Saudi Arabia	1 200 <sup>a/</sup>	1 200	-	2 000 <sup>a/</sup>	-	2 000
Senegal	-	-	-	-	-	-
Sierra Leone	-	-	-	-	-	-
Singapore	1 000 <sup>a/</sup>	1 000	-	1 000 <sup>a/</sup>	1 000	-
South Africa	9 400 <sup>a/</sup>	9 400	-	9 400 <sup>a/</sup>	-	9 400
Spain	13 000	13 000	-	16 600 <sup>a/</sup>	16 600	-
Sudan	-	-	-	-	-	-
Sweden	22 800 <sup>a/</sup>	22 800	-	22 600 <sup>a/</sup>	22 600	-
Switzerland	15 600 <sup>a/</sup>	15 600	-	15 600 <sup>a/</sup>	15 600	-
Syrian Arab Republic	-	-	-	800 <sup>a/</sup>	800	-
Thailand	3 000 <sup>a/</sup>	3 000	-	4 000 <sup>a/</sup>	4 000	-
Tunisia	1 000 <sup>a/</sup>	-	1 000	1 000 <sup>a/</sup>	-	1 000
Turkey	6 400 <sup>a/</sup>	6 400	-	6 400 <sup>a/</sup>	6 400	-
Uganda	1 000 <sup>a/</sup>	1 000	-	1 000 <sup>a/</sup>	-	1 000
Ukrainian Soviet Socialist Republic	-	-	-	-	-	-
Union of Soviet Socialist Republics	166 667	166 667	-	166 667	111 111	55 556
United Arab Republic	11 500 <sup>a/</sup>	11 500	-	11 500 <sup>a/</sup>	-	11 500
United Kingdom of Great Britain and Northern Ireland	110 000	110 000	-	120 566 <sup>a/</sup>	-	120 566
United States of America	485 166 <sup>bc/</sup>	23 000	462 166	630 000 <sup>bd/</sup>	-	630 000
Uruguay	2 000 <sup>a/</sup>	-	2 000	1 600 <sup>a/</sup>	-	1 600
Venezuela	8 200 <sup>a/</sup>	-	8 200	-	-	-
Viet-Nam	1 200 <sup>a/</sup>	1 200	-	1 200 <sup>a/</sup>	1 200	-
Yugoslavia	8 000 <sup>a/</sup>	8 000	-	8 000 <sup>a/</sup>	-	8 000
Zambia	-	-	-	-	-	-
<b>TOTAL</b>	<b>1 492 819</b>	<b>981 853</b>	<b>510 966</b>	<b>1 623 033</b>	<b>472 028</b>	<b>1 151 005</b>

a/ Pledge equals or exceeds the percentage of the target of \$2 million set for voluntary contributions for 1969 or 1970 (see General Conference Resolutions GC (XII)/RES/243, para 1 and GC (XIII)/RES/257, para 1 respectively) which is equal to the Member's percentage assessment under the Regular Budget for the same year.

b/ 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 \$400 000 for the year 1969 and \$750 000 for the year 1970. 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 1969 is provided in the Agency's accounts for last year (GC(XIV)/435, Part IV, Schedule G).

c/ The United States pledged an amount equal to 32.5% of all contributions for 1969 that are paid by the end of 1970, up to a percentage of the target equal to its percentage assessment under the Regular Budget for 1969.

d/ The United States pledged an amount equal to 40% of all contributions for 1970 that are a paid by the end of 1971, up to a percentage of the target equal to its percentage assessment under the Regular Budget for 1970.