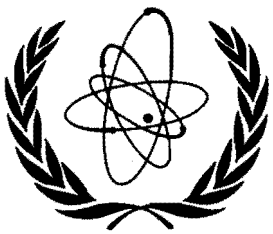
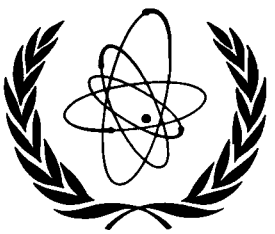


International Atomic Energy Agency

ANNUAL REPORT TO THE ECONOMIC AND SOCIAL COUNCIL OF THE UNITED NATIONS FOR 1965-66



International Atomic Energy Agency

ANNUAL REPORT TO THE ECONOMIC AND SOCIAL COUNCIL OF THE UNITED NATIONS FOR 1965-66

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THE AGENCY'S ANNUAL REPORT TO THE ECONOMIC AND SOCIAL COUNCIL OF THE UNITED NATIONS FOR 1965-66

The text of the Agency's annual report to the Economic and Social Council of the United Nations for 1965-66 is reproduced in this document for the information of all Members.

ANNUAL REPORT BY THE INTERNATIONAL ATOMIC ENERGY AGENCY TO THE ECONOMIC AND SOCIAL COUNCIL FOR 1965-66

(For the period 1 April 1965-31 March 1966)

CONTENTS

ANNEXES

List of Abbreviations

ACC	Administrative Committee on Co-ordination
Agency	International Atomic Energy Agency
Board	Board of Governors of the International Atomic Energy Agency
ECOSOC	Economic and Social Council of the United Nations
ENEA	European Nuclear Energy Agency (of the Organisation for Economic Co-operation and Development)
EPTA	United Nations Expanded Programme of Technical Assistance
EURATOM	European Atomic Energy Community
FAO	Food and Agriculture Organization of the United Nations
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ILO	International Labour Organisation or International Labour Office
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization
WMO	World Meteorological Organization

NOTE

All sums of money are expressed in United States dollars.

INTRODUCTION

1. Information is given on all the main activities of the Agency in its report to the General Assembly of the United Nations for 1964-65 [1]. The present report, which covers the period 1 April 1965 to 31 March 1966, concentrates on developments in two subjects of particular interest to ECOSOC, namely:

(i) Application of science and technology to development; and

(ii) Trends in the Agency's technical co-operation programmes.

2. ECOSOC may also be interested to know the level of the Agency's budgets during the two financial years in question. In 1965 the Agency's Regular Budget amounted to $7 938 000, of which $7 713 000 represented assessed contributions from Member States; in addition, as the Agency's manning table was completely filled for the first time, a supplementary appropriation of a sum not exceeding $100 000 was made in order to cover additional payroll and associated costs, if required. The Regular Budget for 1966 has been set at $8 744 000, of which $8 426 500 represent assessed contributions.

3. The Agency's Operational Budget amounted to $2 468 000 in 1965 and has been set at $2 478 000 for 1966. Of these amounts $2 million represents the target set for the voluntary contributions from Member States for each year; the balance in each case is to be obtained from special contributions for specific purposes and from minor miscellaneous income. By 31 March 1966 actual pledges of voluntary contributions for 1965 amounted to 62.85% and for 1966 to only 54.17% of the targets, resulting in a proportionate reduction in the operational programmes financed from this budget.

4. During the past year the Secretariat has been participating in the ACC study on the preparation and submission of Agency budgets requested by ECOSOC in Resolution 1090 D (XXXIX). It is also co-operating with the Ad hoc Committee of Experts established by General Assembly Resolution 2049 (XX) which is examining the finances of the United Nations, the specialized agencies and the Agency.

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[1] United Nations documents A/5951 and Add. 1 - Agency documents GC(IX)/299 and INFCIRC/65.

I. APPLICATION OF SCIENCE AND TECHNOLOGY TO DEVELOPMENT

5. Under this heading in last year's report [2] material was included on six topics which had been selected by the Agency for consideration by the Advisory Committee on the Application of Science and Technology to Development as being of particular importance to the developing countries.

6. The Agency believes that it will help to narrow the focus of the Advisory Committee's work and will also meet the Council's own interests if the present report concentrates on three subjects:

(i) Nuclear power;

(ii) Nuclear techniques and their relation to the development and efficient use of water resources; and

(iii) The use of radioisotopes in industry.

7. All three subjects are directly related to industrial development. The first two are of great potential importance to developing countries. Indeed, it is increasingly being recognized that abundant fresh water is as important as cheap energy in promoting industrial development. The third is a good example of a technology which is already widely applied in the industrialized countries (although the limits of its application are far from having been reached) and which, if a special effort is made, can be of much value to developing countries. Information on recent developments in the three subjects, on Agency projects and work in co-operation with other organizations is given in Annex I to this report.

8. A summary of other scientific and technical work of the Agency, which makes a direct economic or social contribution to the welfare of the developing countries, is given below.

1. Agriculture

9. The general uses of radiation and isotopes in industry are described in Annex I. However, mention should be made here of developments in the food industry to which the Joint FAO/IAEA Division of Atomic Energy in Agriculture, which was established in October 1964, has given attention during the past year. Based on the findings of a mission to Turkey in March 1964, a project was submitted to and approved by the Governing Council of the Special Fund in June 1965 for the construction in Antalya of a plant for the disinfestation of grain. This is a pilot plant from which it is hoped to demonstrate the feasibility and practicability of radiation disinfestation and stimulate the interest of the grain handling industry in different countries of the world.

10. An International Symposium on Food Irradiation will be held jointly by FAO and the Agency in June 1966 in Karlsruhe, at which information will be exchanged on progress made in recent years and further possibilities for the future. It will deal with radiation sources, the microbiology of irradiated food, chemical, physiological and physical effects of radiation on food, wholesomeness, the acceptance of irradiated food by the consumer, packaging, and the economics of food irradiation. The present status of irradiation of various commodities will be considered, including meat and meat products, poultry and eggs, fish and seafood, fruit and vegetables, grain and stored products. The programmes of different facilities already in operation and of those planned for the future will be discussed and particular consideration will be given to legislative aspects of food irradiation from the international standpoint.

11. Work continued in collaboration with ENEA and the Austrian Society of Atomic Energy Studies on the joint fruit and fruit juice irradiation programme initiated in 1964.

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[2] United Nations document E/4022 - Agency document INFCIRC/61.

12. Work started on a Central American Project for Eradication of the Mediterranean Fruit Fly which is being supported by the Special Fund, and an FAO/Agency international training course on the use of radioisotopes in entomology, which was attended by students from 20 countries, was held in October/November 1965 at the University of Florida, United States of America.

13. Students from 19 countries received instruction at an advanced FAO/Agency training course on radioisotopes in animal science and veterinary medicine, which was held at Cornell University, United States, from July to September 1965. In November 1965 a panel of experts was convened on the use of isotopes and radiation in animal science which made a series of recommendations on intermediary metabolism in domestic animals and on further studies to be made to combat parasitic diseases.

14. An FAO/Agency Symposium on the Use of Isotopes in Weed Research was held in Vienna in October 1965 at which information was exchanged on recent advances in weed research resulting from the use of nuclear and other advanced techniques and on possible future application of isotopes.

2. Nuclear medicine

15. Nuclear medicine remains one of the most important branches of nuclear science in the developing countries. This is not only due to the fact that radioisotopes are applied in the study, diagnosis or treatment of many tropical and endemic diseases, but also because medicine itself is usually one of the first large-scale applications of science in such countries. There is also scope in nuclear medicine for a direct practical use of one of the products of newly-established research reactors, namely of short-lived radioisotopes.

16. Nuclear medicine, therefore, has continued to play a significant part in the Agency's training, technical assistance and research contract programmes, accounting for 31 of the fellowships awarded in 1965. Two advanced training courses were held in London and Bangkok respectively during the reporting period.

17. During the year, moreover, arrangements were made to supply equipment, under the auspices of the Agency, for teletherapy centres in five countries. Details concerning these arrangements are given in Annex III.

18. The Agency and WHO are jointly studying the question of providing support for an international centre for nuclear medicine following the receipt of offers to the Agency by Austria and the Czechoslovak Socialist Republic.

19. To ensure that the Agency's resources and those of WHO in this field are used to the best advantage there must be close co-ordination between the two organizations. This is being achieved mainly by the work of technical liaison officers at each other's headquarters, who take part in the planning and execution of the projects carried out by each organization. This arrangement is proving to be increasingly effective.

20. The Agency has continued to hold a number of highly specialized meetings on subjects such as the long-term biological effects of radiation, the use of computers in radiation dosimetry and the clinical uses of whole-body counters (instruments used to measure the total amount of radioactivity in the human body).

3. Health and safety standards

21. Any country with plans for a nuclear science programme must ensure adequate protection against possible exposure to ionizing radiation both of the personnel connected with the programme and the general public. Under its Statute the Agency has responsibility for drawing up health and safety standards for use by Member States.

22. The Basic Safety Standards for Radiation Protection,[3] first established in 1962, were revised during the year to take into account recommendations of an Agency panel of experts, comments submitted by Governments and recent amendments to recommendations of ICRP.

23. The revised Regulations for the Safe Transport of Radioactive Materials were published in May 1965.[4] These regulations, which were revised in collaboration with a number of international organizations concerned with transport problems, incorporate more data concerning the designing and testing of packages for radioactive materials. The revised regulations were accepted in September by the United Nations Committee of Experts on the Transport of Dangerous Goods, and reference to these regulations will be included in the United Nations Code of Practice on the Transport of Dangerous Goods.

24. The Agency published codes of practice on the provision of radiological protection services and on personnel monitoring and, together with ILO, convened a panel of experts in May 1965 which has drawn up a code of practice on radiological protection in the milling and mining of nuclear materials.

4. Research contracts

25. In 1965 the Agency awarded 68 new contracts, and renewed 88 contracts it had awarded earlier to institutes for research in subjects relating to the Agency's technical programmes. The Agency's contribution to this research amounted to $842 617.

5. Exchange of information

26. Also directly relevant to the introduction of nuclear technology in developing countries is the Agency's programme for the exchange of the latest scientific and technical information on the peaceful uses of atomic energy. In 1965, for example, 15 international scientific conferences were held by the Agency, at which there was a free exchange of information among scientists from Member States. The Agency published the proceedings of these meetings in addition to issuing a number of technical reports, guides, directories and journals, including further numbers of The Atomic Energy Review and Nuclear Fusion. The Agency has provided services in nuclear science documentation and abstracts, and has loaned publications, documents and films to Member States on request from its reference library.

27. During the year plans were discussed by the Secretariat with Governments of Member States for the extension of the Agency's documentation activities. In October 1965 an electronic computer was rented which is being used for information storage and retrieval and serves the various technical programmes of the Agency.

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[3] Agency publication STI/PUB/26.

[4] Ibid., STI/PUB/97.

II. TRENDS IN THE AGENCY'S TECHNICAL CO-OPERATION PROGRAMMES

28. The main sources of finance of these programmes are the Agency's General Fund, which consists of voluntary contributions by Member States, and EPTA. A list of voluntary contributions by Member States to the General Fund for 1965 and 1966 is given in Annex II. Details of funds budgeted and available for technical assistance from these two sources are given in the two tables below.

29. Requests to the Agency for all forms of technical assistance have continued to increase during the past year. It will be noted that the total resources available (including EPTA) to the Agency for technical assistance and training have increased from $1 768 000 in 1961 to $2 182 584 in 1965. However, as will be seen from the first of the tables below, voluntary contributions to the General Fund have been diminishing since 1963, making it impossible to meet more than a small percentage of the requests received from developing countries. Although some changes in emphasis in the programme have been introduced in 1965 with a consequent qualitative improvement, the widening gap between the funds required to meet the essential needs of developing countries and the resources made available negate the qualitative improvement in the programme.

Funds for technical assistance under the Agency's regular programme

Item	1961 $	1962 $	1963 $	1964 $	1965 $
Target set for voluntary contributions to the General Fund	1 800 000	2 000 000	2 000 000	2 000 000	2 000 000
Amount pledged	1 261 200	1 380 470	1 437 394	1 374 447	1 256 920
Amount budgeted for technical assistance	1 361 000	1 625 000	1 799 000	1 680 000	1 749 000
Funds available for technical assistance	980 881	1 146 294	1 209 173	1 063 224	1 199 526

Funds for technical assistance under EPTA

Biennial period	Amount $
1961/62	1 630 000
1963/64	2 099 000
1965/66	2 141 000

30. Member States have continued to make contributions in kind and donations of equipment to further the purposes of the Agency in addition to the voluntary contributions to the General Fund referred to above. Details of the equipment offered and donated as contributions in kind during the reporting period are given in Annex III.

31. The Agency provided further training in 1965 for students by the different means at its disposal. It awarded 313 fellowships, financed assignments of 153 experts and visiting professors as advisers and lecturers in Member States, and held ten international or regional training courses.

32. In addition, the Agency is now Executing Agency for four Special Fund projects as indicated in the table below.

Agency/Special Fund projects

Country or region	Title of project	Project duration (years)	Plan of operation signed (date)	Special Fund Governing Council earmarkings $
Yugoslavia	Nuclear research and training in agriculture	3	8 April 1963	610 600
Philippines	Pre-investment study on power, including nuclear power, in Luzon	2	14 February 1964	477 500
Central America	Eradication of the Mediterranean fruit fly	3	29 July 1965	870 200
Turkey	Pilot project for radiation disinfestation of stored grain	3	-	564 500

33. Following the adoption by the General Assembly of the United Nations of Resolution 2029(XX) concerning the consolidation of the Special Fund and EPTA in a United Nations Development Programme, the Agency has made arrangements for its participation in the new programme. An account of its experience of the new consolidated programme will be included in its report to ECOSOC for 1966-67.

ANNEX I

SCIENCE AND TECHNOLOGY: DEVELOPMENTS IN THREE TOPICS SELECTED BY THE AGENCY AS BEING OF PARTICULAR IMPORTANCE TO THE DEVELOPING COUNTRIES

1. Nuclear power

(a) Recent developments

1. As a result of the information exchanged on nuclear power at the Third International Conference on the Peaceful Uses of Atomic Energy (Geneva, August/September 1964), the United Nations Scientific Advisory Committee concluded:

> "The rapid rise of nuclear power as a major source of energy promises to be of decisive importance to the economic development of the world."

2. As indicated at the Conference, the advent of nuclear power has been one of the factors which have tended to prevent increases in the price of conventional fuels in recent years. Its influence in this direction is likely to become more marked in the future.

3. Since September 1964, developments suggest that the rise of nuclear power will be even more rapid than was foreseen at that time. Projections made then indicated that approximately 20 000 MW(e) of nuclear power plants would be built by 1970; this estimate has now been revised to 25 000 MW(e). Contracts and commitments made in the year 1965 clearly offer also abundant evidence of this upward trend. In the United States of America, contracts for approximately 5000 MW(e) of nuclear capacity were concluded in the course of 1965.[1] Corresponding figures for the EURATOM group of countries and for the United Kingdom are of the order of 1200 MW(e) each. The United Kingdom has announced the construction of a prototype fast reactor with an electrical output of 250 MW. In Canada construction has started on a 1000-MW(e) station (two MW(e) units). Evidence of an increasing role for nuclear power is also forthcoming from the Soviet Union and other Eastern European countries. Contracts were issued for 400 MW(e) in Sweden, for 300 MW(e) in Spain, for 350 MW(e) in Switzerland and for more than 300 MW(e) in Japan. Present construction plans for nuclear power plants will lead to the commissioning of 580 MW(e) in India and more than 200 MW(e) in Pakistan by 1970. Consideration is being given to the introduction of nuclear power plants in several other developing countries.

4. This evidence of rapid growth follows from further reductions in nuclear power costs. The large nuclear plants for which contracts have been concluded in the United States appear competitive even in areas with relatively low fossil fuel prices (25-26 cents/mill.BTU), while the new AGR power station ordered in the United Kingdom appears to offer generating costs which would be 10-15% lower than those of the most efficient coal station expected to be commissioned in that country at the end of this decade. These costs are for plants larger than 500 MW(e), but even in the range between 100-300 MW(e) substantial economies may be obtained from the use of nuclear power in areas where fossil fuel is relatively expensive.

5. The expected growth of nuclear power has led to several studies on the adequacy of the world's uranium resources. Sufficient uranium is available in the world to sustain any power programme that could be contemplated at present and the question is essentially the effect that rising demand will have on prices. It must be borne in mind that only a small fraction of total fuel cycle costs is affected by the price of uranium and that any rise in ore prices may well be offset by further decreases in the cost of fabricating and reprocessing of nuclear fuel. In the long run even more decisive results can be expected from the development of converter or breeder reactors using thorium, and of fast breeder reactors

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[1] It may be noted that the total installed capacity of nuclear power plants throughout the world stood at 5000 MW(e) at the beginning of 1965.

using plutonium as fuel. Prospecting for low- and medium-cost uranium, which has been discouraged by over-supply in recent years, is also expected to revive in the near future.

(b) The Agency's work

6. In response to the needs expressed by Member States, the Agency has been increasing its activities in several areas, which are described below.

7. During 1965 the Agency sent panels of experts to the Philippines, the Republic of Korea and Tunisia to give preliminary advice on the selection of sites suitable for construction of nuclear power plants in the near future. In November 1965 an international symposium was held in Stockholm on an important safety problem, namely the criticality control of fissile materials.

8. In view of the rapid developments in thorium technology and the interest of several developing countries, such as India, Brazil and the United Arab Republic, in exploiting their extensive thorium reserves, a panel on the utilization of thorium in power reactors was convened in June 1965. The information presented to the panel indicated that reactors containing thorium as fertile material could be very attractive from an economic standpoint and lead to better utilization of available nuclear fuels.

9. In order to facilitate prompt exchange of fundamental nuclear data needed for the design of power reactors, the Agency has organized several meetings of specialists from leading centres and established a nuclear data group in the Secretariat to co-ordinate the exchange of information.

10. Studies are continuing on the integration of nuclear stations in electric power systems, and of the special problems of nuclear power costing in developing countries.

11. In 1965 the Agency dispatched a preliminary power survey mission to Turkey and also participated in a preliminary feasibility study of nuclear power in Argentina.

12. Much more detailed analyses than those which can be made by a preliminary mission are necessary before a final decision is made regarding construction of a nuclear power plant. This type of analysis has been carried out by the Agency for the Philippines. The Council has already been informed of the Pre-Investment Study on Power, Including Nuclear Power, in Luzon that the Agency is executing on behalf of the Special Fund in the Philippines. Phase A of this study, involving the evaluation of available energy resources and projected power requirements for the next ten-year period, was completed in February 1965. The results indicated that in view of the limited indigenous energy resources, the country will have to depend upon importation of fuel, and nuclear power could offer a possible alternative to fuel oil. Under Phase B of the project detailed cost estimates for nuclear and conventional plants have been made, and power system planning studies have been undertaken to develop an optimum power expansion programme for the Luzon Grid. A comprehensive report on the project will be submitted to the Government early in 1966. It is hoped that the approach and the techniques used in analysing the possible role of nuclear power with reference to the Luzon Grid in the Philippines will be of interest to several Member States who may wish to make similar assessments.

(c) Co-operation with other organizations

13. The Agency has continued to co-operate with the Resources and Transport Branch of the United Nations in energy and power matters. For example, the United Nations acted as sub-contractor for parts of Phase A of the pre-investment study in the Philippines described above. In addition a United Nations expert has participated in a recent power survey mission sent to Turkey by the Agency. The Council will also recall that the Agency was able to outpost a power economist to the United Nations Resources and Transport Branch. This

arrangement ended in July 1965, but it is hoped that it may be reinstituted in future on a reciprocal basis.

14. The Agency is now co-operating with ENEA in a continuing survey of world uranium and thorium resources.

2. Nuclear techniques and their relation to the development and efficient use of water resources

15. Work under this heading falls into two broad categories:

(a) The use of nuclear energy for water desalination; and

(b) The use of nuclear techniques to develop underground and surface water resources.

(a) The use of nuclear energy for water desalination

(i) Recent developments

16. The Council and the Advisory Committee on the Application of Science and Technology to Development were informed last year of the stage reached in nuclear desalting technology. The prospects of using nuclear energy for dual- and single-purpose desalting plants have improved as a result of further advances, but generally speaking nuclear schemes will need to be fairly large-scale to be eoonomic.

17. A comprehensive review of desalting technology and of the use of both nuclear and conventional energy for desalting was provided at the first International Symposium on Water Desalination which was organized by the United States Government in Washington, D.C., in October 1965.

18. The construction of a dual-purpose nuclear desalting plant using a fast breeder reactor is proceeding satisfactorily at a site by the Caspian Sea to reduce 94 500 m^3/day and 150 MW(e). The Soviet Union is conducting optimization studies for 2000-3000-MW(th) plants using multiple-effect and multi-stage flash evaporators. In addition, it is designing small single-purpose desalting plants using organic coolants, with an output of 15-70 MW(th).

19. The United States is undertaking further studies on power plant systems for single- and dual-purpose plants. In Southern California a study is being made of a plant which would desalt 190 000-570 000 m^3 per day and produce 150-750 MW of electric power, later extended to 1600 MW, and another desalting plant study is in progress for New York City.

20. In 1965 the United Kingdom Government announced that the United Kingdom Atomic Energy Authority would assume responsibility on behalf of the Government for research and development in the methods of desalination. The Authority has started a substantial programme in collaboration with British industry. This includes studies of dual-purpose nuclear schemes, which could be undertaken now using present-day technology without further development. An example is a scheme which would provide 400 MW electricity for sale and 270 000 m^3/day of desalted water from six 45 000-m^3/day units.

21. Recently several feasibility studies have been completed for large-capacity single- and dual-purpose nuclear desalting plants which could be built on the basis of present technology and some additional research and development work. Such studies have shown that in Israel [2] a plant producing 380 000 m^3 per day and 200 MW(e) of electricity would yield water in the range of 7-15 cents/m^3 depending upon the fixed charges (5-10%) used

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[2] Study of Large Desalting Plants for Israel. Paper by N. Arad, First International Symposium on Water Desalination, Washington, D.C., October 1965.

and other factors. In the United States [3] it is estimated that a larger plant yielding 570 000 m^3 per day and generating about 150-1600 MW(e) net would produce desalted water from 6 to 8 cents/m^3. This estimate is based on relatively low fixed charges and other favourable assumptions.

22. In the light of current information on nuclear reactors and experience with desalting plants it can be stated with confidence that large nuclear desalting plants will produce fresh water cheaply enough for domestic consumption and for some industrial purposes (the accepted price for water for industrial purposes has a very wide range depending upon the quality requirements). However, the cost of water for agricultural use must be considerably lower. As the Advisory Committee has pointed out, there are factors that could in time make desalted water economically feasible for agriculture. These include the development of salt-resistant crops and better conservation of water, a large proportion of which goes to waste in most irrigation practices currently in use.

(ii) The Agency's work

23. In October 1965 a tripartite agreement was concluded between the Agency, Mexico, and the United States [4], under which a joint study group was established to make a preliminary assessment of the technical and economic practicability of a dual-purpose nuclear power plant designed to produce fresh water and electricity for the arid region in the states of Arizona and California in the United States and for the states of Baja California and Sonora in Mexico. The Agency is co-ordinating this study and is providing the chairman and a scientific secretary for the study group.

24. The Agency has been represented at further meetings of the United States-Israel Joint Board which is making a feasibility study for a dual-purpose plant which would produce 200 MW(e) of electricity and 380 000 m^3 per day.

25. The cost of desalted water depends greatly on assumptions used in a given situation, particularly for dual-purpose plants. In order to review the different methods employed for making such cost estimates, the Agency is convening a Panel on Costing Procedures for Nuclear Desalination in April 1966.

(iii) Co-operation with other organizations

26. Co-operation with the United Nations has included the participation of the United Nations in a panel convened by the Agency on nuclear desalination in April 1965, and participation by the Agency in the United Nations Inter-Regional Seminar on the Economic Application of Water Desalination in September 1965.

27. Two staff members of the United Nations participated in a preliminary survey mission which was sent on request by the Agency in March 1966 to review nuclear desalting prospects in Chile and Peru.

(b) Use of nuclear techniques to develop underground and surface water resources

(i) Recent developments

28. The interest in the application of isotope techniques in hydrology has increased during recent years. Current work includes measurements of discharge of rivers; sediment measurements; snow hydrology and glaciology; measurement of velocity and direction of groundwater movement; measurement of soil moisture, seepage from reservoirs and

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[3] Study of 150 MGD Desalted Water Power Dual-Purpose Plants for Southern California. Paper by H. Holton and L. Galstaun, presented to the above-mentioned symposium.

[4] INFCIRC/75.

canals, geochronology of aquifer systems, based on ^{14}C and tritium dating; and the study of isotopic composition of water bodies to identify their relationship and the possible areas of recharge. The use of ^{14}C for dating in hydrological studies has received increased attention in the past year, although the interpretation of ^{14}C data still requires considerable refinement.

29. However, progress has not been equally successful in all the above applications. Difficulties were encountered especially in measurements of large flow rates of rivers, and in direction and velocity measurements of groundwater flow. On the other hand, sediment transport studies and geochronological studies involving ^{14}C and tritium dating were encouraging. The isotopic composition of water also proved to be a very useful tool in basin-wide studies for the identification of different water bodies and their relationships.

(ii) Agency projects, including work in co-operation with other organizations

30. Investigations of the groundwater system in the region of Lake Chala, Kenya, have made it possible to define the relationship of this lake with springs flowing in the same area; it was also possible to estimate the turnover rate of the lake.

31. In the current Agency project in Antalya, Turkey, where the relationship of lakes and springs in a karst region has been studied, positive results have been obtained using tritium and stable isotope data. These results are of great importance for the water resource development schemes in the region.

32. A study which is being made of the southern Vienna Basin is in its initial phase, but the tritium data obtained are significant and promising. Other groundwater studies have been initiated as part of Special Fund projects in Jamaica and Jordan, which have given preliminary results of interest.

33. The most significant development during 1965 has been the beginning of the International Hydrological Decade programme by UNESCO which added fresh impetus to hydrological work and promoted international co-operation. The Agency has subscribed to this programme from the start. The Agency will be active mainly in the following areas:

(a) Collection of basic data related to tritium concentration in precipitation and in major rivers of the world;

(b) Inventories and water balances;

(c) Geochronology (^{14}C and tritium dating);

(d) Water content of the unsaturated and saturated zones;

(e) Groundwater movement;

(f) Application of stable isotope techniques; and

(g) Nuclear techniques in snow hydrology and glaciology.

34. The Agency is already involved in such studies in co-operation with national authorities and other international organizations, such as FAO, UNESCO and WMO, and is awarding research contracts to institutes in different countries. Future prospects of the application of isotope techniques in hydrology are rather encouraging and require increased effort on the part of the Agency. This effort will be channelled mostly towards the projects considered in the International Hydrological Decade programme and in Special Fund projects in co-operation with other agencies.

35. The dissemination of information concerning isotope techniques and the training of hydrologists is also considered as an important part of the Agency's programme. To this end the Agency is planning to assist developing countries by publishing manuals on the widely accepted isotope techniques, and to organize regional training courses for hydrologists, in addition to the regular working group meetings and symposia it holds.

3. The use of radioisotopes in industry

(a) Description of activities

36. The technical and economic advantages resulting from the use of radioisotopes in industry are well documented. In a survey [5] conducted by the Agency in 1964, for example, it was shown that their use resulted in net world savings of some $300-400 million per annum.

37. The United Nations has given much attention to the importance of industrial expansion in developing countries and to the need for wider and more intensive application of existing scientific knowledge and techniques. Many industrial radioisotope techniques are now well developed, but their application is not as wide or as intensive as they merit, even in developed countries.

38. The uses of radioisotopes in industry can be divided into the following main categories: radioisotope instruments; gamma radiography; radiation sources and radioisotope tracers. The extent of the application of radioisotope instruments, for example, can be judged by the fact that there are at present some 40 000 in routine use throughout the world. Technical details of these various applications are being given separately to the Advisory Committee on the Application of Science and Technology to Development.

(b) The Agency's work

39. The programme of the Agency in promoting industrial uses of radioisotopes is mainly directed towards publicizing and promoting the industrial uses of radioisotopes, encouraging the establishment of a central radioisotope group in each Member State where such a group is justified, assisting these and already existing groups in every way possible, and encouraging and assisting research on the development of new techniques of particular interest to developing countries or a number of Member States.

40. The Agency provides technical assistance in the form of experts, organization of regional projects, and the award of fellowships. It also provides advisory, field, laboratory and information services as required.

41. Experts are sent to Member States to advise on or assist in general uses of, for example, radioisotope instruments and tracers; professors or lecturers are also assigned to academic institutes.

42. Fellowships are awarded to enable personnel to receive instruction in other countries, and scientific visits and study tours can be arranged by the Agency to enable scientists to be shown laboratories and factories using standard radioisotope techniques in routine work or developing new techniques.

43. Research on problems of national importance which are of interest to a large number of Member States, such as development of mineral resources and pollution studies, is carried out under the Agency's research contract programme. Laboratory facilities should soon be available to supplement this effort by short-term research and development, mainly directed at adapting developed techniques to the conditions existing in developing countries and standardization of techniques. These facilities may also be used by trainees from developing countries to learn the different techniques, or by scientists to carry out research on their own national problems.

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[5] Industrial Radioisotope Economics, Agency publication STI/DOC/10/40.

44. Distributing information on the use of radioisotopes in industry includes the collection and distribution of books and films; the preparation of bibliographies [6] and technical manuals of guidance; and the organization of scientific meetings at which the information on current uses and latest developments is exchanged [7]. Smaller panels and study groups are convened periodically to discuss or give advice on specialized topics [8]. Plans are being made for these groups to discuss subjects such as construction work (roads, dams, etc.), and the manufacture of pulp and paper and basic metals.

(c) Co-operation with other organizations

45. As radioisotopes are applied to a wide range of industrial problems, co-operation with other organizations with interests in such problems is essential. The Agency is co-operating with WHO in a project concerning water supply and sewage for Istanbul which is being supported by the Special Fund. The Agency's participation concerns the use of radioisotopes to detect leaks in pipelines and measure the dispersion of sewage pumped into the sea.

46. The Agency has reported annually on its work on the application of radioisotopes in industry to the United Nations Committee for Industrial Development. In addition it has made arrangements for co-operation with the Resources and Transport Branch of the United Nations and with the Industrial Development Centre concerning the application of radioisotope techniques in mineral resources development and in industrial research centres.

47. The Agency is now making plans to hold a meeting on radioisotope tracers in industry and geophysics.

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[6] E.g. Radioisotope Applications in Industry, Agency publication STI/PUB/70.

[7] E.g. Symposium on Radioisotope Instruments in Industry and Geophysics, Warsaw, October 1965, the proceedings of which will be published by the Agency in 1966.

[8] E.g. Panel on the Uses of Radioisotopes in the Development of Natural Resources, Cracow, October 1965, the report of which will be published by the Agency in 1966.

ANNEX II

VOLUNTARY CONTRIBUTIONS BY MEMBER STATES TO THE AGENCY'S GENERAL FUND FOR 1965 AND 1966

Member	Contribution pledged (equivalent in United States dollars at Technical Assistance Board rates)		Paid $	Paid $
	1965	1966	1965	1966
Argentina	15 000	16 600	-	-
Australia	20 000	20 000	20 000	20 000
Austria	8 200	9 600	8 200	-
Belgium	10 000	-	10 000	-
Bolivia	800	-	-	-
Brazil	19 000	17 200	-	-
Burma	1 000	1 000	1 000	-
Canada	57 400	57 200	57 400	-
Ceylon	2 100	2 100	2 100	-
China	5 000	5 000	5 000	-
Colombia	-	1 000	-	-
Congo, Democratic Republic of	2 000	-	-	-
Denmark	10 600	11 200	10 600	11 200
El Salvador	-	800	-	-
Ethiopia	1 000	-	-	-
Finland	6 800	7 800	6 800	-
France	30 612	-	30 612	-
Germany, Federal Republic of	104 800	120 000	104 800	60 000
Ghana	1 600	1 400	1 600	-
Greece	4 200	4 600	4 200	-
Guatemala	500	-	500	-
Holy See	2 000	2 000	2 000	2 000
India	35 000	35 000	35 000	35 000
Indonesia	2 000	2 000	2 000	-
Iran	2 000	2 000	2 000	-
Iraq	1 600	1 400	1 600	1 400
Israel	2 800	3 000	2 800	-
Italy	a/	a/	-	-
Japan	40 000	50 000	40 000	-
Korea, Republic of	3 000	2 400	-	-
Kuwait	800	1 000	800	1 000
Lebanon	1 000	-	1 000	-
Liberia	6 301	-	6 301	-
Madagascar	-	800	-	800
Mali	800	-	800	-
Mexico	13 600	a/	13 600	-
Monaco	2 000	2 000	2 000	-
Morocco	2 600	-	2 600	-
Netherlands	18 600	18 600	18 600	-
New Zealand	-	5 000	-	-

Member	Contribution pledged (equivalent in United States dollars at Technical Assistance Board rates)		Paid	
	1965	1966	$ 1965	$ 1966
Norway	8 200	8 000	8 200	-
Pakistan	6 000	6 000	6 000	-
Peru	1 800	-	-	-
Philippines	4 000	6 200	4 000	6 200
Portugal	3 600	3 600	3 600	-
Saudi Arabia	1 200	-	1 200	-
South Africa	9 800	9 400	9 800	-
Spain	10 000	10 000	-	-
Sweden	24 000	23 000	24 000	-
Switzerland	17 600	15 800	17 600	-
Thailand	3 000	2 600	3 000	-
Turkey	4 444	6 200	4 444	4 405
United Arab Republic	11 500	11 500	11 500	-
United Kingdom of Great Britain and Northern Ireland	140 000	130 200	140 000	-
Uruguay	2 000	-	-	-
Venezuela	-	9 000	-	-
Viet-Nam	2 449	1 400	2 449	-
Yugoslavia	7 000	6 400	7 000	6 400
	691 306	650 000	636 706	148 405
United States of America (including matching contribution)	565 614 b/	433 333 c/	200 000	-
Total	1 256 920	1 083 333	836 706	148 405

a/ Amount to be announced later.

b/ Equivalent to 45% of the total pledged by all Member States including the United States.

c/ Equivalent to 40% of the total pledged by all Member States including the United States.

ANNEX III

CONTRIBUTIONS OF EQUIPMENT BY MEMBER STATES

A. Equipment offered as contributions in kind

1. The Council will recall the offers to establish medical radiological centres in developing countries, made by the Governments of Bulgaria, the Byelorussian Soviet Socialist Republic, the Czechoslovak Socialist Republic, Hungary, Poland, Romania, the Ukrainian Soviet Socialist Republic and the Union of Soviet Socialist Republics.[1]

2. During the reporting period, equipment for such centres requested by Afghanistan has been donated by the Government of Hungary, and centres requested by Burma, Iraq, Morocco and Pakistan were donated by the Soviet Union.

3. The radiological centre which was offered by the Government of the Czechoslovak Socialist Republic to Algeria started to operate during the reporting period.

B. Equipment donated as contributions in kind

4. The table below lists equipment donated during the reporting period for furthering the purposes of the Agency.

Equipment donated to the Agency's Laboratory

Donor country	Equipment
France	A 4096-channel 2-parameter gamma-ray spectrometer and a 2-Ci ^{60}Co source
India	6 radiation survey meters and 3 contamination monitors
Japan	1 mass-spectrometer for isotopic analysis and 1 scaler

5. In 1965 the United States donated equipment grants in kind for the following projects within the Agency's approved programme.

[1] INFCIRC/61, Annex III, paras. 1-3.

Equipment donated for approved technical assistance projects in Member States

Recipient country	Equipment
Brazil	A plant growth chamber
Chile	Some components for a spin resonance spectrometer
China	A medical scintillation scanning system
Colombia	Actigraph paper electrophoresis system and vacuum distilling apparatus
Pakistan	For scientific documentation project microcard reader, Recordak microfile machine, Recordak reader-printer. Film processing equipment, photo-copy machine, roll to roll printer, etc.
Philippines	Laboratory monitors survey meters, analysis unit kit, ionization meter and miscellaneous radio-chemical accessories
Thailand	Hygrothermograph, low temperature cabinets, moisture testers, laboratory counters, vacuum-pressure pump and other accessories
Uruguay	Carborne scintillometer assembly for uranium prospecting