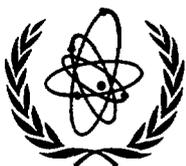


THE
AGENCY'S PROGRAMME
FOR 1979 - 84
AND BUDGET
FOR 1979

GC(XXII)/600

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INTERNATIONAL ATOMIC ENERGY AGENCY

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LIST OF ABBREVIATIONS

ACABQ	Advisory Committee on Administrative and Budgetary Questions of the General Assembly of the United Nations
Agency	International Atomic Energy Agency
AGRIS	Agricultural Information System
CCAQ	Consultative Committee on Administrative Questions
CEC	Commission of the European Communities
CINDA	Computer Index of Neutron Data
CMEA	Council for Mutual Economic Assistance
DTPA	Diethylenetriaminepentaacetic acid
EAAFRO	East African Agriculture and Forestry Research Organization
ECE	Economic Commission for Europe (of the United Nations)
ECOSOC	Economic and Social Council of the United Nations
EDTA	Ethylenediaminetetraacetic acid
EPPO	European and Mediterranean Plant Protection Organization
EPR	Electron paramagnetic resonance
ESNA	European Society for Nuclear Methods in Agriculture
EUCARPIA	European Association for Research on Plant Breeding
EURATOM	European Atomic Energy Community
EXFOR	Exchange Format for Neutron Data
FAO	Food and Agriculture Organization of the United Nations
GS	General Service category (staff)
GSF	Gesellschaft für Strahlen- und Umweltforschung (Federal Republic of Germany)
HTGR	High-temperature gas-cooled reactor
IAEA	International Atomic Energy Agency
IAKW	Internationales Amtszit- und Konferenzzentrum Wien, AG
IATA	International Air Transport Association
IBRD (World Bank)	International Bank for Reconstruction and Development

ICAO	International Civil Aviation Organization
ICRISAT	International Crop Research Institute for the Semi-arid Tropics
ICRP	International Commission on Radiological Protection
ICRU	International Commission on Radiation Units and Measurements
ICSC	International Civil Service Commission
ICSU	International Council of Scientific Unions
IEA	International Energy Agency
IIASA	International Institute for Applied Systems Analysis
IITA	International Institute for Tropical Agriculture
ILCA	International Livestock Centre for Africa
ILO	International Labour Organisation
ILRAD	International Laboratory for Research on Animal Disease
IMCO	Inter-Governmental Maritime Consultative Organization
INFCE	International Nuclear Fuel Cycle Evaluation
INIS	International Nuclear Information System
IOBC	International Organization for Biological Control of Noxious Animals and Plants
IRRI	International Rice Research Institute
ISO	International Organization for Standardization
IUPAC	International Union of Pure and Applied Chemistry
Joint FAO/IAEA Division	Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture
LMFBR	Liquid-metal fast breeder reactor
LWR	Light-water reactor
M&O	Maintenance and Operatives Service category (staff)
MHD	Magnetohydrodynamics
Monaco Laboratory	International Laboratory of Marine Radioactivity at Monaco
NEA	Nuclear Energy Agency (of OECD)
NMR	Nuclear magnetic resonance
NPT	Treaty on the Non-Proliferation of Nuclear Weapons (reproduced in document INFCIRC/140)

NUSS programme	Agency's programme on nuclear safety standards for nuclear power plants
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
P	Professional category (staff)
PNE	Nuclear explosions for peaceful purposes
SABRAO	Society for the Advancement of Breeding Research in Asia and Oceania
SAC	Scientific Advisory Committee
Salzburg Conference	International Conference on Nuclear Power and its Fuel Cycle
SIDA	Swedish International Development Authority
Trieste Centre	International Centre for Theoretical Physics at Trieste
UNDP	United Nations Development Programme
UNDRO	Office of the United Nations Disaster Relief Co-ordinator
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNIPEDA	International Union of Producers and Distributors of Electrical Energy
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UPU	Universal Postal Union
US-AID	United States Agency for International Development
USDA	United States Department of Agriculture
WHO	World Health Organization
WMO	World Meteorological Organization
World Bank (IBRD)	International Bank for Reconstruction and Development

NOTE

All sums of money are expressed in United States dollars.

INTRODUCTION

General

1. In accordance with Article XIV.A of the Statute, the Board of Governors hereby submits to the General Conference the budget estimates for 1979, the preliminary estimates for 1980 and the Agency's programme of work for the six-year period 1979-84. The Board requests the Conference to adopt the draft resolutions set forth in Annex VII.

2. The estimates for 1980 are based on conditions and trends as known now and are presented as preliminary estimates only. Final budget estimates for 1980 will be presented to the General Conference at its twenty-third regular session, with supporting programme explanations if significant changes have occurred. Adjustments to the preliminary figures may be necessary as a result of changes in programme emphasis or of factors outside the control of the Agency.

Programme trends

3. The "Technical Assistance" programme foresees the taking of several measures aimed at increasing the Agency's capability to respond effectively to the requests of Member States for technical assistance and at making better and fuller use of technical assistance funds. Emphasis will be placed on maximizing the developmental impact of technical assistance projects in Member States. In line with the advice given by an expert group on Agency technical assistance programme implementation, which met in August-September 1977, this could be achieved through the establishment of larger-scale, longer-term projects more closely co-ordinated with Member States' economic development priorities; smaller-scale projects, which will continue to exist, will - as far as possible - also be co-ordinated with those priorities. Consequently, programming assistance, including consultations with Member States and Missions, will be arranged on a sectoral basis or, when the application of nuclear techniques in various sectors of the national economy is involved, will take the form of assistance in general programming. It is planned to initiate training for liaison officers appointed by Member States to serve as Agency technical assistance co-ordinators within their countries. The Agency's "Technical Assistance" programme will be strengthened through staff increases in the Programme Co-ordination Section, the Africa Section, the Fellowships and Training Section, the Training Courses Section, the Experts Section and the Equipment Section.

4. In the nuclear power and nuclear fuel cycle area, the Salzburg Conference produced a wealth of information and conclusions which were carefully reviewed and taken very much into account during the preparation of this document. The Salzburg Conference made it clear - inter alia - that, due to revisions of nuclear power and nuclear fuel cycle policies and programmes which have taken place in Member States, forecasting of the demand for and supply of nuclear power, nuclear fuel and nuclear fuel cycle services has become much more difficult. It is therefore planned to continue improving the methods for collecting and processing demand, supply and other relevant data and to provide for the continuous updating of information on national nuclear programmes. Assistance to Member States in nuclear power programme formulation and implementation will continue, with the emphasis shifting from advice on planning to a more project-oriented approach which includes advice on obtaining both nuclear power plant components and nuclear fuel and nuclear fuel cycle services. It is considered that the increasing scope and complexity of nuclear power and fuel cycle programmes and of related activities at the national and the international level, as highlighted at the Salzburg Conference, warrant the holding periodically of further conferences on the same lines to review the status, problems and prospects of nuclear power and problems of definition of options and integration of the nuclear fuel cycle; the holding of such a conference in 1981 or 1982 is planned.

5. Activities connected with nuclear manpower development will be strengthened and will include assistance to Member States in assessing their manpower requirements, the preparation of guidelines on the training and qualifications required for selected categories of nuclear power plant staff, the preparation and continuous updating of an inventory of

facilities for training in fields connected with nuclear power and its fuel cycle, the organization of training courses and the arranging of on-the-job training at facilities in Member States and the provision of advice on the long-term planning of nuclear manpower development.

6. Under the "Nuclear Safety and Environmental Protection" programme, the Agency's radiological safety standards and recommendations will be gradually reviewed and brought into line with the latest recommendations of ICRP. It is planned to arrange for a comprehensive review, in 1980, of the Agency's regulations on the safe transport of radioactive materials; work in this area is to be expanded. As regards the treatment and disposal of highly radioactive wastes, the formulation of guidelines for underground disposal will continue to be a major activity, as will the reviewing of progress in research and development. It is foreseen that the guidelines for underground disposal will cover regulatory activities, siting, waste acceptance criteria, the design and construction of repositories and the operation and shutdown of depositories. The formulation of nuclear safety standards for thermal-neutron nuclear power plants (under the NUSS programme) is scheduled to be completed in 1982. A procedure will be established for reviewing and supplementing codes and guides already issued. The personnel which becomes available as the work on standards for thermal-neutron plants is phased out will be gradually transferred to work on preparing safety codes and guides for advanced reactor types and for nuclear fuel cycle facilities.

7. Under the "Food and Agriculture" programme, it is planned to continue work in the main areas where applications of nuclear techniques have become established as indispensable tools. The large mass-rearing facility now under construction in Mexico is expected to bring about a breakthrough in the large-scale application of the sterile-insect technique against fruit flies, especially the Mediterranean fruit fly. Mass-rearing techniques developed in the Agency's Laboratory will be employed at the facility, which is also expected to play a leading role in the provision of training. Work will continue on tsetse fly rearing techniques, which will be applied during a field project in Nigeria. As there is a need for large-scale, long-term wholesomeness experiments to serve as a basis for international acceptance of the irradiation of broad groups of foods or even of the food irradiation process as such, it is planned to continue the International Project in the Field of Food Irradiation (IFIP) at least until 1981.

8. Under the "Life Sciences" programme, it is planned to complete a range of activities relating to instrument requirements for nuclear medicine in developing countries by 1981; the result should be recommendations on - and arrangements for the construction of prototype instruments for - the application of selected nuclear medicine procedures and improved strategies for instrument maintenance under the conditions encountered in developing countries. Assistance, mainly through dose intercomparison services, will continue to be given to the laboratories constituting the network of Secondary Standards Dosimetry Laboratories, the number of which is expected to rise from 9 in 1977 to 35 in 1980. In connection with the expected expansion of the use of radiation for food preservation, work aimed at achieving standardization of dosimetry methods and procedures in this area is planned. Co-operation with WHO, UNEP and research centres in Member States will be established with a view to developing a methodology for comparing biological hazards from radioactive and chemical pollutants, including a method whereby the effects of different chemical pollutant types can be expressed in terms of rem-equivalents. Increased attention will be paid to the application of nuclear techniques in environmental research. Health impacts of nuclear and non-nuclear power generation will be reviewed at an Agency symposium in 1980.

9. Training, research co-ordination and meetings of experts will be organized under the "Physical Sciences" programme for the purpose of helping developing Member States to make optimum use of their research reactors and neutron generators. In the area of plasma physics, the Agency will continue - mainly through the International Fusion Research Council (IFRC) - to assist leaders of national fusion programmes in the co-ordination of their research. Member States have been asked whether they would be interested in the Agency's

playing a role in establishing an international study group to examine the objectives and the main physical features of a small demonstration fusion power plant which would constitute one of the next large steps in the development of fusion technology; if the results of the enquiry are positive, the Secretariat would be ready to perform the functions involved. The results of work on compiling, evaluating and disseminating atomic and molecular data for use in fusion research and development, which was initiated in 1977 for a trial period of two years, will be evaluated thoroughly and recommendations concerning future Agency activities in this field formulated; both IFRC and the International Nuclear Data Committee will be involved in the evaluation.

10. The Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA)[1], which was extended for a second five-year period in 1977, will be used increasingly to help Member States in South Asia, in South East Asia and the Pacific and in the Far East with the introduction of nuclear methods and techniques into industry, agriculture, medicine and environmental research and monitoring. It is expected that co-ordinated research programmes used as a means of initiating work on selected subjects under RCA will gradually develop into large, regional Agency technical assistance projects and, in certain cases, into still larger UNDP projects. It is hoped that developed countries - particularly those in the areas covered by RCA - will find it possible to contribute more to RCA activities. The Agency will continue to assist Member States which are parties to RCA in co-ordinating their research and development efforts and their activities aimed at practical applications in selected fields.

11. The organizational restructuring of the Department of Safeguards has been essentially completed and it is expected that the period 1979-80 will see substantial progress in the strengthening of Agency safeguards. The manpower of the Divisions of Operations will be increased because of the anticipated growth in the inspection work load, due - inter alia - to requirements arising from the continuous evaluation of safeguards effectiveness; the manpower of the Division of Safeguards Information Treatment will be increased in line with the consequent large growth in the volume of safeguards data to be handled; the manpower of the Safeguards Evaluation Section will be brought to a level where the Section is fully operational; regional offices will be set up and resident inspectors posted to nuclear facilities; and the Safeguards Analytical Laboratory (SAL) will attain the originally envisaged operational level upon full licensing of SAL itself and licensing of the shipment of samples to it.

12. Development work on safeguards procedures, methods and instrumentation will continue, and the results will be tested at operating facilities or in field exercises. Modelling techniques will be used more widely in examining safeguards concepts and criteria. The manifold criteria applied in safeguards effectiveness evaluation will be reviewed and improved. In the area of information treatment, the establishment of an advanced safeguards information system will be completed.

13. It is planned to take, during the period 1979-80, several measures aimed at helping Member States to make more effective use of INIS; for example, the results achieved with the experimental system for providing Member States with direct on-line access to the INIS data base will be evaluated and conclusions formulated regarding the establishment of a permanent system and its expansion. The scope of INIS will be expanded in 1979 to include the medical applications of ionizing radiation and radionuclides. In view of the fact that rapid technical progress is taking place in the nuclear information area, it is planned to convene the INIS Advisory Committee in 1979 and invite it to make recommendations on the development of INIS.

14. With the move to the Permanent Headquarters in the Donaupark, the Agency will assume additional responsibilities for providing, on a cost-sharing basis, library and computer services for UNIDO and the United Nations under the agreement with these organizations on joint services.

[1] INFCIRC/167.

Adjustments made in the budget estimates and manning table for 1978

15. Since the Agency's budget for 1978 was approved, various actions affecting the budget estimates for the different programmes have been taken. In order to permit a meaningful comparison with the 1979 estimates, a "1978 Adjusted Budget" has been drawn up. The considerations underlying the adjustments are set out below.

16. The initial programme cost estimates for 1978 were based on an exchange rate of 18.50 Austrian schillings to the United States dollar. In the light of the substantial fall in the exchange rate during 1977, the General Conference appropriated \$4 300 000 under appropriation Section 10 of the Regular Budget - Adjustment of programme cost estimates - in order to compensate for an estimated average exchange rate of 16.40 schillings to the dollar in 1978. Clearly, if the average exchange rate in 1978 proves to be below 16.40 schillings to the dollar, more than \$4 300 000 will be required. The \$4 300 000 have been allocated so as to show the impact on the various programmes and on the assumption that the average exchange rate in 1978 will prove to be 16.40 schillings to the dollar. All other changes represent transfers of a few posts and of the related costs between programmes within the manning table and the budget estimates approved for 1978.

The Regular Budget for 1979

17. The total of the Regular Budget estimates for 1979 is \$65 177 000.

18. The programme cost estimates are based on an exchange rate of 16.40 schillings to the dollar; they can, therefore, be compared directly with the adjusted programme cost estimates for 1978, which are also based on that rate. Because of the substantial fall in the exchange rate during recent months, however, an amount of \$4 342 000 has been included under appropriation Section 10 of the Regular Budget - Reserve funds for the adjustment of programme cost estimates - in order to compensate for an estimated average exchange rate of 15.05 schillings to the dollar in 1979.

19. Both the programme budget and the Regular Budget are set forth in Table 3. As stated in paragraph 18 above, the programme cost estimates for 1979 are directly comparable to the adjusted programme cost estimates for 1978. The increase for 1979 is \$9 456 000, or 18.4% over the 1978 budget level (see Table 3). The 18.4% is made up as follows: 5.3% for price increases attributable to inflation; 7.0% for programme expansion and 3.8% for the maintenance and operating costs for six months at the Agency's new Permanent Headquarters (together 10.8%); and 2.3% for the one-time costs associated with the transfer to the Permanent Headquarters.

20. The total of the Regular Budget for 1979 is not directly comparable to the total of the Regular Budget for 1978, since it is based on an exchange rate of 15.05 schillings to the dollar, whereas the Regular Budget for 1978 was based on an exchange rate of 16.40. Because different exchange rates were used in making the estimates, the increase in the Regular Budget is \$4 342 000 larger than the increase in the programme budget.

21. Accordingly, the total increase in the Regular Budget for 1979 is \$13 798 000, or 26.9% over the Regular Budget for 1978 (see Table 3). The increase is arrived at as follows: \$7 089 500, or 13.8% for price increases attributable to a combination of inflation (5.3%) and a lower dollar-schilling exchange rate (8.5%); \$5 529 500, or 10.8%, for programme expansion (including \$1 945 000, or 3.8%, for the maintenance and operating costs for six months at the Permanent Headquarters); and \$1 179 000, or 2.3%, for the one-time costs associated with the transfer to the Permanent Headquarters.

22. The Regular Budget estimates for 1979 will be funded by estimated income of \$3 655 000 plus an assessment on Member States of \$61 522 000.

23. The assessment on Member States for 1979 is \$14 259 000, or 30.2%, larger than the assessment for 1978. The increase is the result of price increases due to inflation and

currency fluctuations (\$7 089 500), programme expansion (\$5 190 500, of which \$1 945 000 is for the operating costs for six months at the Permanent Headquarters) and expenses for the transfer to the Permanent Headquarters (\$1 979 000).

24. As in the previous budget document, information is provided on the total extrabudgetary resources expected to be available to the Agency for carrying out its programme in 1979 (see Tables 2 and 7).

Target for voluntary contributions to the General Fund

25. The provision of technical assistance by the Agency to its developing Member States is financed largely from the General Fund, which receives its income mainly in the form of voluntary contributions for which a target is set each year. In 1977, the Board decided to recommend an increase of \$1 million in the target - from \$6 million in 1977 to \$7 million in 1978. In addition, the Board made a special appeal to Member States for additional voluntary contributions in the amount of \$500 000.

26. During its deliberations in 1978 the Board recognized the need on the part of developing countries for an increase in the voluntary contributions to the General Fund and accordingly recommends that the target for 1979 be established at \$8.5 million.

Working Capital Fund

27. The Board recommends that for 1979 the Agency's Working Capital Fund remain at the same level as for 1978, namely \$2 million. The recommendation is reflected in draft resolution C set forth in Annex VII. This level will be adequate to maintain the cash liquidity of the Agency only if Members pay their assessments promptly, as they have for the most part done this year.

Report on the budget to the General Assembly of the United Nations

28. In accordance with Article XVI of the Agency's relationship agreement with the United Nations^[2], the budget will be reviewed by ACABQ, which will report on the administrative aspects thereof to the General Assembly of the United Nations.

[2] INFCIRC/11, Part I.

REGULAR AND OPERATIONAL BUDGETS 1979

Table 1

Programme	Regular Budget	Operational Budget		Total
		Operating Fund I	Operating Fund II	
A. Technical assistance and training	2 651 000	-	8 900 000	11 551 000
B. Nuclear power and reactors	3 353 000	-	-	3 353 000
C. Nuclear safety and environmental protection	4 452 000	-	-	4 452 000
D. Nuclear explosions for peaceful purposes	211 000	-	-	211 000
E. Food and agriculture	3 117 000	-	-	3 117 000
F. Life sciences	2 328 000	-	-	2 328 000
G. Physical sciences	4 793 000	-	-	4 793 000
I. International Centre for Theoretical Physics	710 000	1 165 000	-	1 875 000
J. International Laboratory of Marine Radioactivity	696 000	120 000	-	816 000
K. Safeguards	15 653 000	-	-	15 653 000
L. Information and technical services	4 228 000	-	-	4 228 000
M. Policy-making organs	2 030 000	-	-	2 030 000
N. Executive management and technical programme planning	1 217 000	-	-	1 217 000
O. Administration	6 365 000	-	-	6 365 000
P. General services	6 827 000	-	-	6 827 000
Q. Service activities	125 000	-	-	125 000
R. Transfer of the Agency to its Permanent Headquarters	2 079 000	-	-	2 079 000
S. Reserve funds for the adjustment of programme cost estimates	4 342 000	-	-	4 342 000
TOTAL	65 177 000	1 285 000	8 900 000	75 362 000
<u>Source of funds:</u>				
Assessment on Member States	61 522 000	-	-	61 522 000
Voluntary contributions	-	1 285 000	8 500 000	9 785 000
Extrabudgetary resources	-	-	-	-
Miscellaneous income	3 655 000	-	400 000	4 055 000
TOTAL	65 177 000	1 285 000	8 900 000	75 362 000

EXTRABUDGETARY RESOURCES 1979
(Excluding contributions in kind)^{a/}

Table 2

Programme	Extrabudgetary resources										Total
	FAO	UNDP	SIDA	Belgium	Canada	Germany, F. R.	USA	USSR	UNEP	Other ^{b/}	
A.	-	5 000 000	1 210 000	-	100 000	-	1 000 000	25 000	-	-	7 335 000
B.	-	-	-	-	-	-	-	-	-	850 000	850 000
C.	-	-	-	-	-	-	55 000	-	120 000	-	175 000
D.	-	-	-	-	-	-	-	-	-	-	-
E.	580 000	-	295 000	62 000	-	496 000	30 000	-	-	-	1 463 000
F.	-	-	-	-	-	-	10 000	-	-	-	10 000
G.	-	-	-	-	-	-	-	-	-	-	-
I.	-	-	-	-	-	-	-	-	-	-	-
J.	-	-	-	-	-	-	-	-	100 000	-	100 000
K.	-	-	-	-	120 000	-	700 000	330 000	-	-	1 150 000
L.	-	-	-	-	-	-	-	-	-	-	-
M.	-	-	-	-	-	-	-	-	-	-	-
N.	-	-	-	-	-	-	-	-	-	-	-
O.	-	-	-	-	-	-	-	-	-	-	-
P.	-	-	-	-	-	-	-	-	-	-	-
Q.	-	-	-	-	-	-	-	-	-	-	-
R.	-	-	-	-	-	-	-	-	-	-	-
S.	-	-	-	-	-	-	-	-	-	-	-
TOTAL	580 000	5 000 000	1 505 000	62 000	220 000	496 000	1 795 000	355 000	220 000	850 000	11 083 000

Source of funds:

Assessment on Member States	-
Voluntary contributions	-
Extrabudgetary resources	11 083 000
Miscellaneous income	-
TOTAL	11 083 000

^{a/} In addition to the above indicated cash resources, cost-free experts and consultants, contributions in kind, stipends for fellowships and training courses are provided by Member States.

^{b/} Extrabudgetary resources expected in support of INFCE.

THE REGULAR BUDGET

By programme

Table 3

	1978	Price		Programme		Transfer to		Total change		1979	1980
	Adjusted	increase	%	increase	%	Permanent	Headquarters			Estimate	Preliminary
	\$	\$	%	\$	%	\$	%	\$	%	\$	\$
A. Technical assistance and training (Regular Budget)	2 230 000	137 400	6.2	283 600	12.7	-	-	421 000	18.9	2 651 000	2 964 000
B. Nuclear power and reactors	3 217 000	164 600	5.1	(28 600)	(0.9)	-	-	136 000	4.2	3 353 000	3 822 000
C. Nuclear safety and environmental protection	4 154 000	227 500	5.5	70 500	1.7	-	-	298 000	7.2	4 452 000	5 054 000
D. Nuclear explosions for peaceful purposes	306 000	13 900	4.5	(108 900)	(35.5)	-	-	(95 000)	(31.0)	211 000	221 000
E. Food and agriculture	2 987 000	154 900	5.2	(24 900)	(0.8)	-	-	130 000	4.4	3 117 000	3 499 000
F. Life sciences	2 259 000	106 700	4.7	(37 700)	(1.7)	-	-	69 000	3.0	2 328 000	3 057 000
G. Physical sciences	4 384 000	224 500	5.1	184 500	4.2	-	-	409 000	9.3	4 793 000	5 569 000
I. International Centre for Theoretical Physics											
Regular Budget	600 000	60 000	10.0	50 000	8.3	-	-	110 000	18.3	710 000	750 000
Operating Fund I	1 045 000	170 000	16.3	(50 000)	(4.8)	-	-	120 000	11.5	1 165 000	1 165 000
Sub-total	1 645 000	230 000	14.0	-	-	-	-	230 000	14.0	1 875 000	1 915 000
J. International Laboratory of Marine Radioactivity											
Regular Budget	646 000	31 600	4.9	18 400	2.8	-	-	50 000	7.7	696 000	799 000
Operating Fund I	110 000	6 000	5.5	4 000	3.6	-	-	10 000	9.1	120 000	132 000
Sub-total	756 000	37 600	5.0	22 400	2.9	-	-	60 000	7.9	816 000	931 000
K. Safeguards	12 177 000	630 200	5.2	2 845 800	23.4	-	-	3 476 000	28.6	15 653 000	18 443 000
L. Information and technical services	3 500 000	203 900	5.8	524 100	15.0	-	-	723 000	20.6	4 228 000	4 782 000
M. Policy-making organs	1 866 000	118 600	6.4	45 400	2.4	-	-	164 000	8.8	2 030 000	2 261 000
N. Executive management and technical programme planning	1 119 000	51 300	4.6	46 700	4.2	-	-	98 000	8.8	1 217 000	1 312 000
O. Administration	5 907 000	325 900	5.5	132 300	2.2	-	-	456 000	7.7	6 363 000	7 567 000
P. General services	5 027 000	281 500	5.6	(426 500)	(8.5)	-	-	(145 000)	(2.9)	4 882 000	4 921 000
Permanent Headquarters	-	-	-	1 945 000	-	-	-	1 945 000	-	1 945 000	5 300 000
Q. Service activities	100 000	15 000	15.0	10 000	10.0	-	-	25 000	25.0	125 000	130 000
R. Transfer of the Agency to its Permanent Headquarters	900 000	-	-	-	-	1 179 000	-	1 179 000	-	2 079 000	-
Sub-total: Regular Budget	51 379 000	2 747 500	5.3	5 529 500	10.8	1 179 000	2.3	9 456 000	18.4	60 835 000	70 451 000
Operating Fund I	1 155 000	176 000	15.2	(46 000)	(4.0)	-	-	130 000	11.2	1 285 000	1 297 000
	52 534 000	2 923 500	5.6	5 483 500	10.4	1 179 000	2.2	9 586 000	18.2	62 120 000	71 748 000
S. Reserve funds for the adjustment of programme cost estimates	-	4 342 000	-	-	-	-	-	4 342 000	-	4 342 000	4 808 000
TOTAL: Regular Budget and Operating Fund I	52 534 000	7 265 500	13.8	5 483 500	10.4	1 179 000	2.3	13 928 000	26.5	66 462 000	76 556 000
Source of funds											
Regular Budget:											
Programme budget	51 379 000	2 747 500	5.3	5 529 500	10.8	1 179 000	2.3	9 456 000	18.4	60 835 000	70 451 000
Reserve funds for the adjustment of programme cost estimates	-	4 342 000	-	-	-	-	-	4 342 000	-	4 342 000	4 808 000
Total Regular Budget	51 379 000	7 089 500	13.8	5 529 500	10.8	1 179 000	2.3	13 798 000	26.9	65 177 000	75 259 000
Operating Fund I	1 155 000	176 000	15.2	(46 000)	(4.0)	-	-	130 000	11.2	1 285 000	1 297 000
	52 534 000	7 265 500	13.8	5 483 500	10.4	1 179 000	2.3	13 928 000	26.5	66 462 000	76 556 000
Regular Budget	51 379 000	7 089 500	13.8	5 529 500	10.8	1 179 000	2.3	13 798 000	26.9	65 177 000	75 259 000
Less Miscellaneous income	3 316 000	-	-	339 000	10.2	-	-	339 000	10.2	3 655 000	3 820 000
Transfer of cash surplus	800 000	-	-	-	-	(800 000)	-	(800 000)	-	-	-
Assessment on Member States	47 263 000	7 089 500	15.0	5 190 500	11.0	1 979 000	4.2	14 259 000	30.2	61 522 000	71 439 000

THE REGULAR BUDGET

By item of expenditure

Table 4

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978				1979 Estimate	1980 Preliminary estimate
			Price	Programme	Transfer to Permanent Headquarters	Total		
Salaries and wages								
Established posts	23 638 350	28 295 000	1 862 000	1 779 000	-	3 641 000	31 936 000	37 015 000
Consultants	536 950	797 400	40 300	(103 200)	-	(62 900)	734 500	787 100
Overtime	194 154	173 200	11 200	(23 400)	-	(12 200)	161 000	258 900
Temporary assistance	1 071 922	1 191 000	63 400	(178 300)	-	(114 900)	1 076 100	1 378 100
Sub-total	25 441 376	30 456 600	1 976 900	1 474 100	-	3 451 000	33 907 600	39 439 100
Common staff costs	6 528 704	8 212 400	227 500	491 300	-	718 800	8 931 200	10 173 100
Travel	1 033 743	1 185 100	83 200	60 900	-	144 100	1 329 200	1 742 700
Meetings								
Conferences, symposia, seminars	1 378 492	1 132 000	105 000	(142 000)	-	(37 000)	1 095 000	1 192 600
Technical committees, advisory groups	1 007 579	1 386 500	51 700	76 300	-	128 000	1 514 500	1 655 900
Representation and hospitality	88 476	104 900	5 100	(4 400)	-	700	105 600	119 500
Scientific and technical contracts	1 539 762	2 117 300	108 400	100 800	-	209 200	2 326 500	3 024 500
Scientific supplies and equipment	1 222 869	1 191 000	86 500	76 200	-	162 700	1 353 700	1 688 600
Common services, supplies and equipment	7 071 721	7 319 400	233 600	1 319 200	1 179 000	2 731 800	10 051 200	8 068 500
Permanent Headquarters operating costs	-	-	-	1 945 000	-	1 945 000	1 945 000	5 300 000
Other items of expenditure	402 839	525 800	93 800	(7 100)	-	86 700	612 500	629 500
Transfer of costs:								
Linguistic services	(718 695)	(1 009 000)	(44 000)	136 000	-	92 000	(917 000)	(1 131 000)
Printing and publishing services	(205 892)	(88 000)	(4 200)	(42 800)	-	(47 000)	(135 000)	(155 000)
Reserve funds for the adjustment of programme cost estimates	-	-	4 342 000	-	-	4 342 000	4 342 000	4 808 000
TOTAL Regular Budget and Operating Fund I	44 790 974	52 534 000	7 265 500	5 483 500	1 179 000	13 928 000	66 462 000	76 556 000
Source of funds								
Regular Budget	43 665 006	51 379 000	7 089 500	5 529 500	1 179 000	13 798 000	65 177 000	75 259 000
Operating Fund I	1 125 968	1 155 000	176 000	(46 000)	-	130 000	1 285 000	1 297 000
TOTAL	44 790 974	52 534 000	7 265 500	5 483 500	1 179 000	13 928 000	66 462 000	76 556 000

Summary of income

Table 5

Item	1977 Actual	1978 Adjusted budget	Increase or (decrease) over 1978	1979 Estimate	1980 Preliminary estimate
Assessed contributions on Member States	36 246 830	47 263 000	14 259 000	61 522 000	71 439 000
Transfer of cash surplus	5 408 155 ^{a/}	800 000	(800 000)	-	-
Miscellaneous income					
(a) Attributable to specific programmes					
Publications of the Agency	556 621	490 000	55 000	545 000	580 000
INIS publications including microfiches	294 978	225 000	50 000	275 000	300 000
CINDA publications	15 685	33 000	(18 000)	15 000	30 000
Advertising	16 454	20 000	-	20 000	20 000
Laboratory income	35 276	20 000	-	20 000	20 000
Sale of surplus property	263 857	50 000	-	50 000	30 000
Sale of computer	-	270 000	(270 000)	-	-
IAEA/UNIDO joint services arrangement					
Computer services	238 544	238 000	154 000	392 000	445 000
Printing services	85 584	100 000	25 000	125 000	130 000
Other services	110 417	130 000	(10 000)	120 000	130 000
Amounts recoverable under safeguards agreements from non-member States	55 230	20 000	40 000	60 000	60 000
UNDP programme support cost	392 232	490 000	(90 000)	400 000	400 000
SIDA programme support cost	16 467	30 000	-	30 000	30 000
Other programme support costs	4 787	-	-	-	-
Reimbursable services for AGRIS	71 883	40 000	103 000	143 000	155 000
Sub-total	2 158 015	2 156 000	39 000	2 195 000	2 330 000
(b) Not attributable to specific programmes					
Investment and interest income	959 100	440 000	265 000	705 000	710 000
Refund from the United Nations Joint Staff Pension Fund	70 797	130 000	(55 000)	75 000	80 000
Refund of Value Added Tax	511 497	460 000	90 000	550 000	570 000
Other: Gain on exchange	341 473	-	-	-	-
Other	267 562	130 000	-	130 000	130 000
Sub-total	2 150 429	1 160 000	300 000	1 460 000	1 490 000
Total miscellaneous income	4 308 444	3 316 000	339 000	3 655 000	3 820 000
TOTAL	45 963 429	51 379 000	13 798 000	65 177 000	75 259 000

a/ The amount of \$1 847 333 thereof is available for subsequent use for the transfer of the Agency to its Permanent Headquarters.

THE OPERATIONAL BUDGET

Summary of income, allocations and expenditures

Table 6

Item	General Fund			Operating Fund I			Operating Fund II		
	1977 Actual	1978 Budget	1979 Estimate	1977 Actual	1978 Budget	1979 Estimate	1977 Actual	1978 Budget	1979 Estimate
INCOME									
Voluntary contributions of Member States	5 351 755	7 000 000	8 500 000	-	-	-	-	-	-
Special contributions of Member States:									
Italy	-	-	-	364 242	350 000	700 000	-	-	-
Monaco	-	-	-	78 369	87 000	97 000	-	-	-
Others	-	-	-	83 568	-	-	-	-	-
Direct contributions for special projects:									
UNESCO	-	-	-	322 340	305 000	317 500	-	-	-
UNDP	-	-	-	100 000	180 000	-	-	-	-
SIDA	-	-	-	112 867	100 000	80 000	-	-	-
Others	-	-	-	21 438	-	-	-	-	-
Investment and interest income	248 741	100 000	150 000	-	-	-	-	-	-
Assessed programme costs	-	-	-	-	-	-	203 279	250 000	250 000
Miscellaneous income	-	-	-	40 549	133 000	90 500	84 365	-	-
Additions to unobligated balance	-	-	-	(4 166)	-	-	(82 827)	-	-
Transfer of unobligated balance	-	-	-	-	-	-	(22 163)	-	-
Savings in prior years' operations	-	-	-	6 761	-	-	-	-	-
	5 600 496	7 100 000	8 650 000	1 125 968	1 155 000	1 285 000	182 654	250 000	250 000
Transfers from General Fund to Operating Fund II	(5 600 496)	(7 100 000)	(8 650 000)	-	-	-	5 600 496	7 100 000	8 650 000
TOTAL	-	-	-	1 125 968	1 155 000	1 285 000	5 783 150	7 350 000	8 900 000
ALLOCATIONS AND EXPENDITURES									
Operating Fund I:									
Trieste Centre	-	-	-	1 022 971	1 045 000	1 165 000	-	-	-
Monaco Laboratory	-	-	-	102 997	110 000	120 000	-	-	-
Operating Fund II:									
Technical assistance:									
Experts and equipment	-	-	-	-	-	-	4 082 593	5 000 000	6 300 000
Fellowships and training	-	-	-	-	-	-	1 700 557	2 350 000	2 600 000
TOTAL	-	-	-	1 125 968	1 155 000	1 285 000	5 783 150	7 350 000	8 900 000

EXTRABUDGETARY RESOURCES 1977-1979
(Excluding contributions in kind) ^{a/}

Table 7

Programme	1977 Actual obligations	1978 Estimate	1979 Estimate
A. Technical assistance and training			
UNDP	2 836 275	4 000 000	5 000 000
SIDA	367 675	940 000	1 210 000
Canada	58 464	100 000	100 000
Japan	-	46 500	-
Soviet Union	8 851	25 000	25 000
United States of America	522 793	1 000 000	1 000 000
Sub-total	3 794 058	6 111 500	7 335 000
B. Nuclear power and reactors			
UNEP	42 749	-	-
United States of America	41 904	93 000	-
INFCE	-	864 000	850 000
Sub-total	84 653	957 000	850 000
C. Nuclear safety and environmental protection			
UNEP	50 927	103 000	120 000
United States of America	36 214	70 000	55 000
Sub-total	87 141	173 000	175 000
E. Food and agriculture			
FAO	500 000	585 000	580 000
SIDA	55 373	294 000	295 000
Belgium	-	62 000	62 000
Federal Republic of Germany	341 814	440 000	496 000
United States of America	169 325	132 000	30 000
Sub-total	1 066 512	1 513 000	1 463 000
F. Life sciences			
United States of America	55 167	50 000	10 000
J. International Laboratory of Marine Radioactivity			
UNEP	244 469	104 000	100 000
K. Safeguards			
Canada	-	60 000	120 000
Soviet Union	254 712	331 000	330 000
United States of America	951 153	500 000	700 000
Sub-total	1 205 865	891 000	1 150 000
TOTAL	6 537 865	9 799 500	11 083 000

^{a/} In addition to the above indicated cash resources, cost-free experts and consultants, contributions in kind, stipends for fellowships and training courses are provided by Member States.

THE PROGRAMME BUDGET

A. TECHNICAL ASSISTANCE AND TRAINING

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table A. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	1 244 374	1 475 000	104 000	131 000	235 000	1 710 000	1 915 000
Consultants	62 146	32 000	1 800	6 200	8 000	40 000	41 000
Overtime	1 306	1 700	100	-	100	1 800	2 000
Temporary assistance	34 825	9 600	600	2 800	3 400	13 000	30 000
Sub-total	1 342 651	1 518 300	106 500	140 000	246 500	1 764 800	1 988 000
Common staff costs	343 855	427 400	14 400	37 000	51 400	478 800	526 500
Travel	49 764	46 000	3 200	5 800	9 000	55 000	75 000
Representation and hospitality	590	1 300	100	-	100	1 400	1 500
Other items of expenditure	556	-	-	-	-	-	-
Transfer of costs:							
Linguistic services	157 821	182 000	10 000	26 000	36 000	218 000	233 000
Printing and publishing services	63 526	47 000	3 000	35 000	38 000	85 000	80 000
Data processing services	3 944	8 000	200	39 800	40 000	48 000	60 000
Other	5 783 150	7 350 000	<u>a/</u>	<u>a/</u>	1 550 000	8 900 000	8 900 000 ^{c/}
TOTAL	7 745 857	9 580 000	137 400^{b/}	283 600^{b/}	1 971 000	11 551 000	11 864 000
Source of funds:							
Regular Budget	1 962 707	2 230 000	137 400	283 600	421 000	2 651 000	2 964 000
Operating Fund II	5 783 150	7 350 000	<u>a/</u>	<u>a/</u>	1 550 000	8 900 000	8 900 000
	7 745 857	9 580 000	137 400	283 600	1 971 000	11 551 000	11 864 000

a/ Since the total change of \$1 550 000 is largely due to the raising of the target for voluntary contributions to the General Fund, no distribution between price and programme increases for 1979 has been made.

b/ Excluding the pro-rating of the total change in respect of Operating Fund II from 1978 to 1979.

c/ This figure, which assumes the same target as for 1979, is included solely for the purpose of completing the column.

SUMMARY OF MANPOWER

Table A. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
D	1	1	1	-	1	1
P-5	7	8	8	-	8	8
P-4	11	11	11	-	11	12
P-3	4	4	4	4	8	10
P-2	2	2	2	1	3	3
Sub-total	25	26	26	5	31	34
GS	36	38	38	2	40	44
TOTAL	61	64	64	7	71	78

CHANGES IN COSTS AND MANPOWER

Costs

A.1. As will be seen from Table A.1 above, the cost of this programme under the Regular Budget is expected to increase by \$421 000 in 1979, of which \$137 400 will be required to cover salary and other price increases and \$283 600 will be a programme increase.

A.2. A programme increase of \$168 000 is foreseen in respect of salaries for established posts and common staff costs due to the addition of four P-3 posts and three GS posts and to the fact that posts for which recruitment has been delayed in 1978 will be filled throughout 1979. An amount of \$6200 will be required for additional consultants' services and \$2800 for temporary assistance.

A.3. A programme increase of \$5800 in respect of duty travel will be required for the provision of advisory services in connection with technical assistance projects. With regard to service costs, increases of \$26 000 for linguistic services, \$35 000 for printing and publishing services and \$39 800 for data processing services are foreseen.

A.4. The increase of \$1 550 000 in the Operational Budget is attributable to an increase in the target for voluntary contributions from \$7 million for 1978 to \$8.5 million for 1979, and to an increase of \$50 000 in other income.

A.5. As can be seen from Table 2 ("EXTRABUDGETARY RESOURCES 1979"), it is expected that UNDP will put \$5 million at the Agency's disposal, and it is hoped that \$1 210 000 will be made available by SIDA for technical assistance. An amount of \$25 000 is foreseen for special fellowships to be financed from funds contributed for that purpose by the Government of the Soviet Union, and an amount of \$100 000 will be available in 1979 from a special contribution offered by the Canadian Government to finance technically sound projects for which no funds are available under the Operational Budget. The United States Government will contribute \$1 million for financing the provision of experts' services and of equipment.

Manpower

A.6. As will be seen from Table A.2 above, the addition of four P-3 posts and three GS posts and the reclassification of one GS post to the P-2 level are foreseen for 1979. Detailed justifications for the additional posts and for the reclassification are provided in Annex V.

A.7. For 1980, the addition of three Professional and four GS posts will be required: one P-4 post, one P-3 post and one GS post for the Latin America Section, one P-3 post and two GS posts for the Experts Section and one GS post for the Training Courses Section.

THE PROGRAMME

OBJECTIVE

A.8. The objective is to promote the transfer to developing countries of skills and knowledge relating to the use of nuclear energy for peaceful purposes in order to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world, in accordance with the Agency's Statute.

A. 9. The mechanisms for achieving this objective are:

- (a) The annual regular programme of technical assistance approved by the Board of Governors, financed from Operating Fund II (the resources of which derive mainly from the General Fund, a target for voluntary contributions to which is set annually by the General Conference) and through additional voluntary contributions in cash and implemented with the help of voluntary contributions in kind;
- (b) The designation of the Agency as executing agency for UNDP projects;
- (c) Special arrangements with donor countries for specific projects financed entirely by those countries; and
- (d) Special funds-in-trust arrangements for the provision of international assistance under the Agency's responsibility.

RESULTS TO DATE

A. 10. Through the technical assistance provided and administered by the Agency, Member States have been able to introduce nuclear technology in a wide variety of fields, ranging from basic to advanced, sophisticated applications. A summary and an analysis of the results achieved are to be found in the annual reports on the provision of technical assistance by the Agency submitted to the Board and subsequently communicated to the General Conference.

A. 11. At the end of 1977, an interdepartmental task force was established to co-ordinate the steps necessary for implementing the recommendations of a panel of experts convened by the Director General earlier in the year.

PLANS FOR 1979-80

A. 12. In line with the recommendations made by the panel of experts, certain managerial and administrative changes will be introduced and emphasis will be placed on the co-ordination of technical assistance requests with all the efforts which the requesting country is making in the particular sector and on stimulating the submission of requests for longer-term projects of a type which in the past was normally financed by UNDP. To achieve such co-ordination, consultations with requesting Member States will be intensified, when necessary by such means as multidisciplinary programming missions. The first such mission (to several countries in Africa, Asia, the Pacific region and Latin America) has been planned for this year. On the basis of the experience gained, detailed programmes for missions to take place in 1979-80 will be prepared in close consultation with the countries involved (two additional Professional posts (at the P-3 level) will be required, one for the Africa Section and one for the Programme Co-ordination Section - see Table A.2 and Annex V).

A. 13. Subject to approval by the Board, it is intended to introduce new, more flexible practices - based on revised Guiding Principles and General Operating Rules to Govern the Provision of Technical Assistance by the Agency - which should make it easier to meet urgent requests for technical assistance.

A. 14. It is foreseen that, with the initiation and expansion of nuclear power programmes in developing countries, there will be an increasing demand for Agency technical assistance in the training of nuclear power project personnel, including staff for States' systems of nuclear materials accounting and control and physical protection systems.

A. 15. The Agency will collaborate with UNDP in studies and preparatory work aimed at greater technical co-operation among developing countries (TCDC) which have reached different stages in specific areas of nuclear technology. Some experience has already been acquired through use of the services of experts from and the placement of fellows for

training in developing countries, but possibilities of more systematic TCDC will be explored, the hope being that assistance in a certain amount and of a certain quality can be delivered at lower cost, that the expertise and training provided will be more suited to the conditions in the recipient country and that the provision of assistance will act as a stimulus to the country providing it.

RELATED ACTIVITIES

A. 16. Technical support for the Agency's technical assistance programme is provided by units within the Department of Research and Isotopes, the Department of Technical Operations and - to a certain extent - the Department of Safeguards and by the Legal Division; administrative support is provided by the Division of Budget and Finance and the Legal Division. On the other hand, because of their specialized knowledge of many countries and their contacts with the authorities and the UNDP resident representatives in those countries, the four area sections in the Division of Technical Assistance (Africa; Asia and the Pacific; Europe and the Middle East; Latin America) frequently serve as intermediaries in other Agency activities - for example, the negotiation of research contracts, the arrangement of symposia and other Agency meetings and the preparation of missions by technical staff members (it should be noted in this connection that such missions are often designed to prepare or complement the provision of technical assistance by the Agency, even if in many cases they are financed out of the regular budget allocations of the technical Divisions concerned).

PLANS FOR 1981-84

A. 17. The technical assistance programme will be expanded further during this period. The Agency will be prepared to assist countries classified by the United Nations as "least developed" as soon as they become able to benefit from simple applications of nuclear technology in such fields as medicine and agriculture.

A. 18. At the same time, with more of the most advanced developing countries entering or preparing for the nuclear power era, the need for assistance relating to such areas as power plant safety, site selection and physical protection is likely to increase considerably. As the number of experts who can be made available by Member States advanced in the field of nuclear power technology is limited, difficulties may be encountered in obtaining the necessary expertise; the Agency will require the full support of such Member States if the need is to be met.

A. 19. It is expected that new approaches in the provision of technical assistance by the Agency may result from the current international deliberations regarding the nuclear fuel cycle; in particular, the emphasis on regional projects may increase.

A. 20. Assistance from or through the Agency for intensified nuclear raw materials prospecting will almost certainly be requested; the provision of such assistance will probably be financed by UNDP in many cases and may involve use of the resources of the United Nations Revolving Fund (in connection with which consultations are at present taking place).

CO-OPERATION WITH OTHER ORGANIZATIONS

A. 21. The Agency keeps other organizations within the United Nations family informed of its annual regular programme of technical assistance and co-operates with them in projects (including UNDP projects) whenever common interests are involved.

A. 22. Special attention will be paid to co-operation with regional intergovernmental organizations interested in the nuclear field and efforts will be made to initiate joint regional projects.

A. 23. Continuous consultation with UNDP and its resident representatives will be necessary in connection with the execution of large-scale, long-term projects for the transfer of nuclear technology, which are becoming increasingly common (the trend is noticeable to a considerable extent in Latin America and to a lesser extent in Africa) within UNDP's system of "country programming" for periods of four to five years; the payment by UNDP of overhead costs proportional to the value of the assistance delivered by the executing agency should ensure that the Agency is reimbursed for the administrative costs which it incurs in executing UNDP projects.

STRUCTURE

A. 24. This programme consists of three sub-programmes, which are dealt with separately below.

SUB - PROGRAMMES

Experts

OBJECTIVE

A. 25. The objective is to provide, through the services of international experts, advice on and training for the implementation of nuclear projects.

RESULTS TO DATE

A. 26. By the end of 1977, the Agency had made the services of about 3200 experts and visiting professors available to 85 countries. As a result of the associated missions, some 1280 reports have been issued; most of them are available to any Member State on request (see the listing annexed to the annual reports on the provision of technical assistance by the Agency).

A. 27. In 1977, a total of 284 experts started field assignments in connection with technical assistance projects - an increase of more than 40% over the average number for the previous three years.

PLANS FOR 1979-84

A. 28. The expected expansion in technical assistance activities will mean an increase in the number of expert assignments during the period 1979-84 (one additional GS post will be required for clerical staff in the Experts Section). Special efforts and new approaches will be necessary if the Agency is to obtain the services of experts in "difficult" fields (particularly in nuclear safety and other aspects of nuclear power projects in developing countries).

Equipment

OBJECTIVE

A. 29. The objective is to purchase and deliver equipment and supplies required for the execution of technical assistance projects and to conduct negotiations and finalize arrangements for the transfer of nuclear fuels and other fissionable materials under project agreements approved by the Board.

RESULTS TO DATE

A. 30. Equipment and supplies valued at \$23.6 million had been purchased and delivered by the end of 1977.

PLANS FOR 1979-84

A. 31. It is expected that the purchase and delivery of equipment and supplies will expand further during the period 1979-84, in line with the growth of the Agency's technical assistance programme (an additional Professional post (at the P-3 level) and an additional GS post will be required - see Table A. 2 and Annex V).

RELATED ACTIVITIES

A. 32. The Equipment Section of the Division of Technical Assistance is also responsible for the purchase and delivery of equipment and supplies required for the research contract programme.

Fellowships and training

OBJECTIVE

A. 33. The objective is to arrange for the training - in foreign countries - of technical and scientific personnel from developing countries through fellowships, scientific visits and study tours, to organize specialized international training courses and to advise on national training programmes in the nuclear field (with special reference to the need for nuclear manpower development).

RESULTS TO DATE

A. 34. By the end of 1977, over 6200 individual fellowships had been awarded; in addition, approximately 3500 engineers, scientists, technicians and government officials had received training through 200 regional and inter-regional training projects organized by the Agency. The training courses on nuclear power project planning and implementation and related subjects (started in 1975 and considerably expanded this year) have been particularly successful.

PLANS FOR 1979-84

A. 35. It is expected that the number of Agency training courses and study tours (which has increased from nine in 1976 to an anticipated 22 this year) will continue to increase in step with the growing demand, especially in connection with nuclear power programmes (an additional Professional post (at the P-3 level) will be required in view of the growing administrative and planning load - see Table A. 2 and Annex V).

A. 36. The programme of fellowships and scientific visits is expected to continue growing and its management to become more complex as more requests are received for training in advanced technology relating to industrial production processes (an additional GS post will be required - see Table A. 2 and Annex V).

A. 37. It is foreseen that, during the period 1979-84, the Agency will gradually become involved in assisting with the building-up of domestic training programmes in developing countries which are embarking on nuclear power programmes and therefore need specialized manpower. It is also foreseen that training in a greater number of languages and at a greater number of levels will be required.

A. 38. Increased emphasis will be placed on training in developing countries, in accordance with the importance being attached to TCDC and in view of the fact that it is becoming more and more difficult to place large numbers of fellows in some advanced countries (besides the possible advantages already mentioned, in certain regions this should help in overcoming language problems; on the other hand, candidate trainees and supporting authorities may sometimes be reluctant to accept awards for training at establishments which the Agency knows to be of a very high standard but which are located in other developing countries).

CO-OPERATION WITH OTHER ORGANIZATIONS

A. 39. Co-operation with UNESCO, ILO, WHO and other organizations within the United Nations family concerned with training in fields related to nuclear technology will be maintained; also, technical assistance will continue to form part of the programmes of the International Centre for Theoretical Physics and the International Laboratory of Marine Radioactivity and of other programmes which are implemented jointly with other international organizations and/or with national Governments.

B. NUCLEAR POWER AND REACTORS

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table B. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	1 227 777	1 381 000	93 000	(13 000)	80 000	1 461 000	1 661 000
Consultants	99 559	117 000	6 500	(43 500)	(37 000)	80 000	135 000
Overtime	725	-	-	-	-	-	-
Temporary assistance	4 897	5 900	400	9 200	9 600	15 500	6 500
Sub-total	1 332 958	1 503 900	99 900	(47 300)	52 600	1 556 500	1 802 500
Common staff costs	340 278	400 900	11 600	(4 700)	6 900	407 800	456 800
Travel	49 739	63 000	4 400	(17 400)	(13 000)	50 000	70 000
Meetings							
Conferences, symposia, seminars	504 089	147 000	4 000	14 000	18 000	165 000	142 000
Technical committees, advisory groups	133 806	161 000	3 000	(7 000)	(4 000)	157 000	220 000
Representation and hospitality	6 473	8 200	500	-	500	8 700	9 500
Scientific and technical contracts	130 554	119 000	6 000	5 000	11 000	130 000	160 000
Scientific supplies and equipment	867	-	-	-	-	-	-
Common services, supplies and equipment	3 643	4 000	200	(200)	-	4 000	2 200
Transfer of costs:							
Linguistic services	147 832	128 000	7 000	5 000	12 000	140 000	200 000
Printing and publishing services	486 899	436 000	24 000	-	24 000	460 000	450 000
Data processing services	154 627	263 000	5 000	24 000	29 000	292 000	328 000
To other: PNE	(15 000)	(17 000)	(1 000)	-	(1 000)	(18 000)	(19 000)
TOTAL	3 276 765	3 217 000	164 600	(28 600)	136 000	3 353 000	3 822 000

SUMMARY OF MANPOWER

Table B. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
D	1	1	1	-	1	1
P-5	11	11	11	-	11	11
P-4	14	14	14	-	14	16
P-3	4	4	4	-	4	4
P-2	2	2	2	-	2	2
Sub-total	32	32	32	-	32	34
GS	16	16	16	-	16	19
TOTAL	48	48	48	-	48	53

CHANGES IN COSTS AND MANPOWER

Costs

B.1. As will be seen from Table B.1 above, it is expected that the cost of this programme will increase by \$136 000 as a net result of salary and other price increases of \$164 600 partly offset by a programme decrease of \$28 600.

B.2. The programme decrease of \$17 700 in respect of salaries for established posts and common staff costs reflects the intention to delay the recruitment of new staff to replace departing staff members. An amount of \$9200 is provided for temporary assistance at the GS level for the component entitled "Energy forecasting, the role of nuclear power and consequent fuel cycle demand". A programme decrease of \$43 500 is foreseen in respect of consultants' services.

B.3. It is planned to hold five symposia and seminars in 1979, the same number as foreseen in the 1978 budget; the programme increase of \$14 000 is attributable to financial participation in international meetings of other organizations. Although an increase in technical committee and advisory group meetings from 18 in the 1978 budget to 20 in the 1979 estimates is planned, a programme decrease of \$7000 is foreseen due to a reduction in the provision of interpretation services for these meetings.

B.4. The programme increase of \$5000 in respect of scientific and technical contracts will be required for additional research contracts in the "Energy forecasts and the economic assessment of nuclear power and its fuel cycle" sub-programme.

B.5. As regards the allocation of service costs, programme increases are foreseen in respect of linguistic services (\$5000), and data processing services (\$24 000).

B.6. It is expected that various Member States will contribute extrabudgetary funds to cover the costs associated with the Agency's participation in INFCE and the costs incurred by the Agency in organizing and servicing INFCE meetings.

Manpower

B.7. As will be seen from Table B.2 above, no additional manpower is foreseen for 1979.

B.8. For 1980 the addition of two P-4 posts (one for the "Uranium conversion and enrichment" component and one for the "Nuclear manpower development" component) and three GS posts will be required.

THE PROGRAMME

OBJECTIVE

B.9. The objective is to provide integrated assistance to Member States in the planning and implementation of national nuclear power programmes, including fuel cycle services and manpower development, and to help in improving the reliability of nuclear power plants by:

- (a) Giving interested Member States technical and economic advice in connection with their programmes and supporting them in ensuring that their nuclear manpower is adequately trained;

- (b) Collecting and disseminating evaluated and systematized information on nuclear power requirements and on proven and advanced nuclear power technologies and on relevant long-standing and new fuel cycle concepts; and
- (c) Assessing the role of nuclear power, compared to other energy options (both conventional and non-conventional), in meeting world energy demands within financing, environmental and manpower availability constraints.

STRUCTURE

B.10. This programme consists of five sub-programmes:

Energy forecasts and the economic assessment of nuclear power and its fuel cycle;

Nuclear raw material resources assessment and development and fuel cycle technologies;

Nuclear power programme formulation and implementation;

Technology of nuclear power plants of proven types; and

Advanced nuclear power technology.

Summary of manpower and costs by sub-programme

Table B. 3

Sub-programme	1979 Estimate			1980 Preliminary estimate		
	Man-years P	GS	Costs	Man-years P	GS	Costs
Energy forecasts and the economic assessment of nuclear power and its fuel cycle	7.2	3.0	628 000	7.2	4.4	710 000
Nuclear raw material resources assessment and development and fuel cycle technologies	10.2	4.0	1 024 000	11.2	5.0	1 238 000
Nuclear power programme formulation and implementation	5.2	4.0	730 000	6.2	4.2	818 000
Technology of nuclear power plants of proven types	5.2	2.0	502 000	5.2	2.2	617 000
Advanced nuclear power technology	4.2	3.0	469 000	4.2	3.2	439 000
TOTAL	32.0	16.0	3 353 000	34.0	19.0	3 822 000

SUB - PROGRAMMES

Energy forecasts and the economic assessment of nuclear power and its fuel cycle

OBJECTIVE

B.11. The objective is to assess the relative role of nuclear power in meeting the future energy demands of Member States, to estimate the present and future trends of the cost components of nuclear plants and their fuel cycles and to compare them with those of the cost components of other energy sources.

PLANS FOR 1979-84

B.12. The far-reaching changes which have taken place since the end of 1973 in both the fossil fuel and the nuclear power area make it more necessary than ever to integrate analyses of the future development of nuclear power into the overall energy demand and supply balances of Member States, of geographical regions and of the world. At the same time, the problems inherent in the nuclear fuel cycle, which were the central theme of the Salzburg Conference, are expected to play a major role at both the national and the international level.

B.13. While some progress is expected to be achieved in at least clarifying the multiple issues in both areas during the 1979-80 period, it seems certain that most of the problems are of a long-term nature and will require continuing study.

STRUCTURE

B.14. This sub-programme consists of two components, which are described in the following paragraphs.

Energy forecasts and the economic assessment of nuclear power and its fuel cycle

Summary by programme components

Table B. 4

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Energy forecasting, the role of nuclear power and consequent fuel cycle demand	3.8	1.5	231 200	-	-	2 800	234 000
Economics of nuclear power and its fuel cycle	3.4	1.5	208 300	-	10 000	2 700	221 000
Linguistic services	-	-	-	-	-	11 000	11 000
Printing and publishing services	-	-	-	-	-	10 000	10 000
Data processing services	-	-	-	-	-	170 000	170 000
Transfers to other programmes for direct support	-	-	-	-	-	(18 000)	(18 000)
TOTAL	7.2	3.0	439 500	-	10 000	178 500	628 000

Energy forecasting, the role of nuclear power and consequent fuel cycle demand

Objective

B.15. The objective is:

- (a) to prepare nuclear power forecasts on a national, regional and world basis, and within the framework of available information on primary energy and electric power, as a foundation for the provision of co-ordinated assistance by the Agency to its Member States; and
- (b) to derive demand and supply projections for nuclear fuels and nuclear fuel cycle services taking into account different nuclear fuel cycle possibilities.

Results to date

B.16. Forecasts of nuclear power growth and of demand for nuclear fuel cycle services have been issued periodically (for example, in the form of joint Agency/NEA publications). An energy data bank in the process of establishment is already partially operational; it provides immediate access to the most important energy data of each Member State. Co-operation with the United Nations Statistical Office, OECD and the World Bank has been established and has proved particularly useful in the areas of conventional energy and of general economic indicators. Methods for deriving projections of energy demand in developing countries were reviewed by an advisory group in 1977.

B.17. Models for forecasting the natural uranium and enrichment services demand corresponding to given nuclear power programmes have gone into use and are providing a continuous series of estimates for the work of the Agency in the nuclear fuel cycle field. They were used in the preparation of survey papers presented jointly by the Agency and NEA at the Salzburg Conference and in the Agency's study of regional nuclear fuel cycle centres.

Plans for 1979-80

B.18. The energy data bank will be completed and continuously updated. Retrieval, processing and aggregation of data will be facilitated through the use of advanced data management programmes. Models for the extrapolation of energy demand into the future will be progressively introduced.

B.19. The models and programmes for nuclear fuel cycle analysis will be expanded and improved to deal with alternative nuclear fuel cycle possibilities.

B.20. Surveys of nuclear power growth and associated estimates of demand for nuclear fuel and nuclear fuel cycle services will be issued annually.

B.21. WASP (Wien Automatic System Planning Package) will continue to be improved so as to take the role of factors such as hydroelectricity more fully into account and updated in the light of changes in the costs of the elements involved in power generation.

B.22. It is expected that questions of energy demand analysis will be reviewed in 1980 (Advisory Group).

Related activities

B.23. Summaries of the energy and relevant general economic data obtained through the energy data bank will be made available on request to Member States and international organizations.

Plans for 1981-84

B.24. The energy data bank will be expanded further. A variety of additional cost and other economic data and a series of programmes based on energy development models and on realistic assumptions regarding interfuel competition will be progressively introduced so as to permit forecasts of energy expansion patterns in Member States closely related to their economic growth.

B.25. Activities concerned with analysis and forecasts of the demand for nuclear fuel and fuel cycle services will continue to gain in importance.

Co-operation with other organizations

B.26. The need to avoid as far as possible duplication of effort in the field of energy analysis, in which a number of international organizations are working, makes co-operation with other organizations essential. The existing links with the United Nations and its regional commissions, OECD, NEA, IEA, IBRD, IIASA and the World Energy Conference will therefore be strengthened and new links will be established with such organizations as UNIDO and OPEC, whose work covers many areas of direct interest to the Agency.

Economics of nuclear power and its fuel cycle

Objective

B.27. The objective is:

- (a) to review continuously the investment and fuel costs of nuclear power plants and of non-nuclear power stations; and
- (b) to review and analyse the competitive status of nuclear power and of different reactor types, with a view to providing Member States with up-to-date cost information relevant to the planning of their nuclear power programmes.

Results to date

B.28. Periodic reviews of nuclear power investment costs, on the basis of experience of construction and of contracting by utilities in Member States (especially developing countries), have been carried out with the assistance of experts from Member States and consulting engineers; the latest review took place in June 1977 (Consultants' Meeting on Extrapolation of Capital Costs Experience to Developing Country Conditions).

B.29. Computer programs for calculating the investment costs of light- and heavy-water nuclear power plants have been adapted with the assistance of consulting engineering firms and used as a basis for analyses of nuclear power programmes in developing countries.

B.30. During the period 1972-77, four technical assistance projects were serviced and a number of fellowship applications and reports evaluated.

Plans for 1979-80

B.31. Detailed cost data on nuclear and conventional plants and fuels will be collected, analysed and progressively introduced into the energy data bank.

B.32. Special attention will be paid to nuclear power plant investment costs, which will be continuously reviewed with the assistance of recent purchasers and consulting engineering firms. The subject will be reviewed again in 1980 (Advisory Group).

B.33. Comparative analyses of total fuel cycle costs with special reference to cost components at the back end of the nuclear fuel cycle will be performed.

B.34. Attention will, as far as possible, be paid to problems of financing. The results of periodic investment and nuclear fuel cost surveys will be published as unpriced "technical documents" in the "IAEA-" series of Agency publications. A revision of the guidebook entitled "Economic evaluation of bids for nuclear power plants" is planned for 1980.

Plans for 1981-84

B.35. The capital and fuel cycle costs of nuclear power systems which are not at present regarded as proven but may emerge as promising alternatives will, to the extent possible, be the subject of detailed analyses similar to those carried out for light- and heavy-water nuclear power plants.

B.36. It is expected that, in addition to the continuous updating of capital and fuel cost data relating to nuclear and conventional power plants, more general economic parameters such as foreign exchange and domestic capital constraints in developing alternative energy sources will be increasingly introduced into nuclear energy analyses.

Co-operation with other organizations

B.37. The co-operation already established with NEA will be expanded. Liaison with organizations active in the field of cost and other economic aspects of nuclear and conventional fuels will also be essential for maintaining an up-to-date picture of the competitive status of nuclear power.

Nuclear raw material resources assessment and development and fuel cycle technologies

OBJECTIVE

B.38. The objective is to maintain an up-to-date picture of world uranium and thorium resources and production, to advise developing Member States on the exploration, development and economic exploitation of their indigenous resources, to collate information on long-standing and new enrichment, reprocessing, storage and recycling technologies and compare their characteristics and to foster the international exchange of information on fuel element technology and related quality assurance questions.

PLANS FOR 1979-84

B.39. Following reassessment of the relative importance of the main activities comprising the old sub-programmes "Nuclear material resources, exploration, evaluation, supply and demand" and "Fuel cycle technology" in the light of the conclusions of the Salzburg Conference, emphasis will be placed on extending activities to cover the existing technological aspects of the uranium-plutonium fuel cycle in all its phases and on initiating technological studies of possible modifications or alternatives to this fuel cycle.

B.40. Current work on the performance and reliability of existing LWR fuel elements will continue with a view to achieving better utilization of nuclear materials.

B.41. The assessment of world uranium resources will continue, the Agency liaising with NEA and interested Member States through the NEA/IAEA Steering Group on Uranium Resources, which is responsible for the International Uranium Resources Evaluation Project.

Other joint activities of the Agency and NEA will include studies of exploration techniques, which may become the subject of co-ordinated research programmes.

STRUCTURE

B.42. This sub-programme consists of four components, which are described in the following paragraphs.

Nuclear raw material resources assessment and development and fuel cycle technologies

Summary by programme components

Table B. 5

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Nuclear raw material resources assessment and development	4.8	1.2	270 800	67 200	28 000	3 000	369 000
Uranium conversion and enrichment	1.6	0.8	98 000	8 800	9 000	3 200	119 000
Fuel element technology and reliability	1.9	1.0	117 000	32 600	6 500	2 900	159 000
Fuel storage, reprocessing and recycling technologies	1.9	1.0	110 900	10 000	6 500	3 600	131 000
Linguistic services	-	-	-	-	-	46 000	46 000
Printing and publishing services	-	-	-	-	-	140 000	140 000
Data processing services	-	-	-	-	-	60 000	60 000
TOTAL	10.2	4.0	596 700	118 600	50 000	258 700	1 024 000

Nuclear raw material resources assessment and development

Objective

B.43. The objective is to maintain an up-to-date picture of world uranium and thorium resources and production by collecting and disseminating information on related subjects such as uranium geology, exploration and evaluation techniques, mining and ore processing and to assist and advise Member States in connection with the exploration, development and economic exploitation of their indigenous resources.

Results to date

B.44. During the period 1972-77, two symposia, six advisory group or technical committee meetings, five consultants' meetings and a number of special working group meetings or workshops were held on uranium geology, exploration, evaluation and ore processing.

B.45. The NEA/IAEA Working Party on Uranium Resources reviewed and issued reports on uranium resources, production and demand in 1973, 1975 and 1977. The International Uranium Resources Evaluation Project (IUREP) was launched in 1976; a report on the world's uranium potential is being issued in 1978.

B.46. As a follow-up to the Symposium on the Oklo Phenomenon, held in 1975, an "International Working Group on Natural Fission Reactors" was set up and met in 1977 and convened a specialists' meeting in December.

B.47. Co-ordinated research programmes on three major subjects relating to uranium exploration and ore processing (Table B. 9, Nos 3-5) were administered, together with a number of individual research contracts.

B.48. Five large-scale UNDP-financed uranium exploration projects - in Greece, Pakistan, Turkey, Chile and Peru - were administered and small-scale projects in a further 28 countries, financed either by UNDP or from the Agency's own technical assistance funds, were supervised; altogether 58 technical assistance projects were serviced and a large number of fellowship applications and reports were evaluated. Three regional or interregional training courses on uranium exploration were held.

Plans for 1979-80

B.49. The NEA/IAEA Working Party on Uranium Resources will meet again in 1979 (Technical Committee - Annex II (1)) and 1980 (Technical Committee) with the objective of producing a new report. The NEA/IAEA Steering Group on Uranium Resources will undertake the formulation and implementation of a programme to follow the first phase of IUREP; for this purpose, technical committee meetings will be held in Vienna in 1979 (Technical Committee - Annex II (2)) and 1980 (Technical Committee). The idea of Agency task forces to assist Member States in the general assessment of their indigenous uranium resources and their exploration policies will be developed, with the assistance of consultants, as part of the second phase of IUREP.

B.50. The NEA/IAEA Group of Experts on Research and Development in Uranium Exploration Techniques will meet again in 1979 (Technical Committee - Annex II (3)) and in 1980 (Technical Committee); it will organize workshops on selected subjects and, through the Agency's research contracts programme, sponsor research projects arising from these workshops.

B.51. An extensive review of uranium evaluation and mining techniques will be conducted in 1979 (Symposium - Annex I (1)).

B.52. Guidance on Agency activities relating to vein-type and similar uranium deposits in developing countries and to uranium exploration techniques in tropical environments will be formulated in 1979 (Advisory Groups - Annex II (4 and 5)). In 1980, subjects such as sedimentary basins and sandstone deposits, uranium geology in Asia and the recovery of uranium from low-grade sources will be reviewed (Advisory Groups).

B.53. Advances in research relating to natural fission reactors will be reviewed in 1979 (Technical Committee - Annex II (6)) and in 1980 (Technical Committee) as a contribution to work on the question of uranium deposit formation and on the problem of the geological disposal of radioactive wastes.

Related activities

B.54. It is expected that several new large-scale technical assistance requests will be received and implemented. The number of requests for technical assistance on a small scale from the Agency's own resources has been increasing steadily and the trend is expected to continue. In view of the success of training courses on subjects relating to uranium, it is proposed that at least one such course be held each year. Training courses on uranium ore processing and geochemical exploration have been proposed for 1979. A course - to be held in Africa - on evaluation methods has been proposed for 1980.

Plans for 1981-84

B.55. The NEA/IAEA Working Party on Uranium Resources will continue to review uranium resources and production capacities at intervals of roughly two years; on the basis of present plans, reports will be published in 1981 and 1983.

B.56. The NEA/IAEA Steering Group on Uranium Resources will be responsible for guiding activities associated with the second phase of IUREP and the NEA/IAEA Group of Experts on Research and Development in Uranium Exploration Techniques will meet at regular intervals to guide research projects.

B.57. It is foreseen that work connected with nuclear raw materials will expand in step with uranium exploration in all parts of the world. As a follow-up to the Symposium on the Formation of Uranium Ore Deposits, held in 1974, a uranium geology symposium will be proposed for 1981; in addition, special aspects of exploration techniques will be the subjects of a number of meetings. The idea of Agency task forces to assist Member States in making inventories of their indigenous uranium resources may be further developed.

B.58. The increased need for uranium is expected to become more evident and to be reflected in a large number of technical assistance requests and programmes.

B.59. The activities of the International Working Group on Natural Fission Reactors will continue, assistance being provided in the search for other natural reactors.

Co-operation with other organizations

B.60. The dissemination of uranium resources information involves co-operation with NEA, with the geology departments of national atomic energy commissions and with national and international geological and mining organizations; co-operation is also being maintained with the International Geological Correlation Programme (sponsored by UNESCO) and IIASA. Future co-operation is envisaged with CEC uranium resources groups, with IEA and with the Uranium Institute.

B.61. Where the provision of technical assistance to developing Member States is involved, co-operation will be maintained with UNDP, with the United Nations Revolving Fund for Natural Resources Exploration and with the United Nations Centre for Natural Resources as well as with the geology departments of national atomic energy commissions and with national geological and mining institutes.

Uranium conversion and enrichment

Objective

B.62. The objective is to collect and evaluate technological information on the front end of the fuel cycle and to study and evaluate already commercialized enrichment technologies and new enrichment processes.

Results to date

B.63. This is a new component, although some activities - in the field of ore processing technology (yellow cake production) - were initiated in 1977.

Plans for 1979-80

B.64. This period will be devoted to the collection of basic information on the technologies being used commercially for yellow cake production and uranium conversion and enrichment. Information will also be collected on uranium enrichment technologies still at the research or conceptual stage, account being taken of enrichment services supply and demand

predictions, development lead times and basic costs. The long-term scope of these activities will be defined in 1979 (Advisory Group - Annex II (7)).

Related activities

B.65. Training courses in the field of yellow cake production may be initiated.

Plans for 1981-84

B.66. Increased attention will be paid to new uranium conversion and enrichment technologies, the aim being to assist in achieving their commercial introduction in the medium term. Technical committee meetings will be held to examine technological progress towards lower power consumption and improved uranium utilization.

Co-operation with other organizations

B.67. It is expected that working relations aimed at complementary action in areas of common interest will be established with such international organizations as NEA and CEC.

Fuel element technology and reliability

Objective

B.68. The objective is to collect, evaluate and provide for the exchange of information on fuel element fabrication technologies (with special emphasis on quality assurance) and fuel element performance and to advise developing countries on the establishment of fuel element fabrication facilities, on quality assurance organization and on in-core fuel management.

Results to date

B.69. The main economic and technical features of fuel element technology were reviewed in 1972. A symposium on fuel and fuel elements for fast reactors and a panel on sol-gel processes for the fabrication of fuel for high-temperature reactors (HTRs) were held in 1973. Advisory group meetings on fuel element behaviour and fuel quality control were held in 1974 and 1975. A seminar on fuel quality and quality assurance took place in 1976.

B.70. The status of water reactor fuel performance and technology in different countries has been reviewed at meetings of the International Working Group on Water Reactor Fuel Performance and Technology (IWGFPT), established in 1976, and recommendations for action by the Agency in these areas have been made. IWGFPT has sponsored a specialists' meeting on pellet-cladding interactions, held in June 1977, and one on fuel element performance computer models, held in March 1978.

B.71. A symposium on water reactor fuel element fabrication with special emphasis on its effect on fuel performance is being held in November of this year.

B.72. A review of the main causes of fuel element failures in water-cooled power reactors, one of improvements in the reliability of water reactor fuels and one of computer programs for the optimization of in-core fuel management have been prepared for publication this year.

B.73. Advisory services have been provided since 1975 within the framework of the UNDP project in Romania; an additional 19 technical assistance projects have been serviced and a number of fellowship applications and reports evaluated.

Plans for 1979-80

B.74. The collection and dissemination of new information on water reactor fuel element research and performance will continue through IWGFPT, which will meet in 1979

(Technical Committee - Annex II (8)) and 1980 (Technical Committee). IWGFPT will also sponsor specialists' meetings dealing with specific aspects of fuel performance and reliability such as internal fuel rod chemistry, power ramping and cycling and the behaviour of failed fuel.

B.75. A regional seminar on quality assurance in nuclear fuel technology for developing countries embarking on the manufacture of nuclear fuel will be held in Latin America in 1979 (Seminar - Annex I (2)).

B.76. In the belief that a broad exchange of information on the designing of fuel to withstand accident and transient conditions and on related thermohydraulic studies and fuel testing would be timely in 1980, it is planned to review (within the framework also of the "Nuclear Safety and Environmental Protection" programme) safety-related aspects of water reactor fuel performance with special emphasis on fuel behaviour under postulated accident conditions (Symposium - Annex III (1)).

B.77. As regards advanced nuclear fuel cycle concepts involving once-through fuel utilization in existing thermal reactor types, depending on the interest shown by Member States, studies of their present technological status may be initiated in 1980 with a view to ascertaining where research and development work is needed (Technical Committee).

B.78. It is foreseen that the review of computer programs for the optimization of in-core fuel management mentioned in paragraph B.72 above may require updating by the end of 1980.

Related activities

B.79. Support for Agency technical assistance projects, including projects being executed by the Agency on behalf of UNDP, will continue to be provided.

Plans for 1981-84

B.80. The main activities will be centred on fuel element reliability, aspects of quality assurance, standardization, the significance of power ramping and power cycling for fuel behaviour and the behaviour of failed fuel. Special attention will continue to be paid to fuel element performance computer models and to pellet-cladding interaction problems.

B.81. As fuel fabrication is an important factor in the safety of reactor operations, emphasis will be placed on the technological aspects of various fabrication processes.

Co-operation with other organizations

B.82. The activities comprising this component involve co-operation with - inter alia - fuel manufacturers and national fuel-testing establishments.

Fuel storage, reprocessing and recycling technologies

Objective

B.83. The objective is to collect, evaluate and provide for the exchange of information on the back end of the fuel cycle, including short-, medium- and long-term storage options and reprocessing and recycling techniques in the context of alternative fuel cycle concepts, and to assist interested Member States in the establishment of multinational fuel cycle centres.

Results to date

B.84. The status of plutonium recycling and of LMFBR fuel reprocessing was reviewed during the period 1974-77 by a number of advisory groups.

B.85. Most of the activities involved in the back end of the fuel cycle were reviewed during the period 1975-77 within the framework of the study of regional nuclear fuel cycle centres (RNFCCs).

B.86. Owing to the prevailing uncertainties about reprocessing and recycling policies, it was felt that the establishment of an international working group on reprocessing should be deferred.

B.87. Consultants' meetings were held in 1977 as a follow-up to the RNFCC study for the purpose of considering - as possible alternatives to reprocessing and recycling - various technologies for the short-, medium- and long-term storage of spent fuel, with emphasis on capacity requirements and scheduling (subjects of a technical seminar organized for 1978 by the United States Nuclear Regulatory Commission in collaboration with the Agency).

B.88. Seven technical assistance projects were serviced and a number of fellowship applications and reports evaluated during the period 1972-77.

Plans for 1979-80

B.89. Depending on the interest of Member States, emphasis may be placed on the technological aspects of different fuel storage concepts and on ways of improving present spent fuel storage techniques in terms of economics and safety (possibly the subject of a symposium to be organized in 1979 by NEA in collaboration with the Agency). A programme for long-term Agency involvement in this field may be formulated in 1980 (Advisory Group).

B.90. Activities connected with reprocessing and recycling will depend largely on the interest of Member States after the completion of INFCE. If sufficient interest is expressed, there will be a resumption of work on uranium-plutonium fuel element reprocessing technologies and topics such as co-processing, direct mixed-oxide fuel manufacture, the pre-irradiation of fuel elements and - possibly - the recycling of uranium only will be considered; guidance on Agency activities relating to alternative reprocessing methods will be formulated in 1980 (Advisory Group).

Related activities

B.91. Assistance could be provided, as a follow-up to the RNFCC study, to groups of Member States in establishing regional and/or multinational fuel cycle centres.

B.92. If the international plutonium management concept meets with the interest of Member States, the Agency may have an important role to play.

B.93. Support for technical assistance projects will continue, with special emphasis on fuel storage.

Plans for 1981-84

B.94. Activities during this period will depend largely on the outcome of INFCE and on expressions of interest by Member States. If it is felt that the Agency's activities need to be redirected, advisory group meetings will be convened for the purpose of formulating guidance. Present activities connected with fuel storage and LMFBR fuel reprocessing will continue.

Co-operation with other organizations

B.95. Co-operation with NEA and EURATOM will continue. Co-operation with international bodies set up as a result of INFCE is envisaged.

Nuclear power programme formulation and implementation

OBJECTIVE

B.96. The objective is to assist Member States, in particular those which are developing countries, in the formulation of nuclear power programmes and the execution of nuclear power projects.

PLANS FOR 1979-84

B.97. There has been a rapid increase in the number of developing countries actively considering the initiation of nuclear power programmes, and this has led to a steady increase in the number of requests for Agency advisory missions to help in programme formulation and for technical assistance - provided from the Agency's own resources or financed by UNDP - in the establishment of infrastructure (supporting industries, quality assurance systems, etc.) in connection with specific nuclear power projects. The number of requests for assistance in programme formulation can be expected to decrease once most countries with grids large enough to take nuclear power plants of proven types have formulated economically well-founded nuclear power programmes. However, shortages of qualified manpower are emerging as a major constraint on the transfer of nuclear technology, so that additional emphasis is to be placed on nuclear manpower development.

STRUCTURE

B.98. This sub-programme consists of four components, which are described in the following paragraphs.

Nuclear power programme formulation and implementation

Summary by programme components

Table B. 6

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Survey of nuclear power applicability in developing countries	1.1	0.7	68 500	35 600	-	2 900	107 000
Economic and technical planning of nuclear power programmes	1.1	0.7	68 500	6 600	-	10 900	86 000
Nuclear manpower development	2.0	2.0	159 500	58 800	15 000	13 700	247 000
Assistance with project-related activities and domestic infrastructure development	1.0	0.6	60 000	-	-	3 000	63 000
Linguistic services	-	-	-	-	-	55 000	55 000
Printing and publishing services	-	-	-	-	-	140 000	140 000
Data processing services	-	-	-	-	-	32 000	32 000
TOTAL	5.2	4.0	356 500	101 000	15 000	257 500	730 000

Survey of nuclear power applicability in developing countries

Objective

B.99. The objective is to collect and evaluate information on the potential demand for nuclear power plants in developing countries and to obtain a picture of the potential market for nuclear power and the availability of nuclear power plants of appropriate size.

Results to date

B.100. This component was initiated in 1971 and the results of the Market Survey for Nuclear Power in Developing Countries were published in 1973; this survey was extended and the results updated in 1974. One purpose of the survey was to demonstrate the need for power reactors in the low and medium power ranges. The survey showed that the market is potentially large. However, it continues to be doubtful whether such reactors will be made available commercially. A catalogue of designs was published in 1975. According to information gathered through annual meetings held during the period 1974-77, the capital costs would be high.

B.101. Twelve technical assistance projects were serviced and a number of fellowship applications and reports evaluated during the period 1972-77.

Plans for 1979-80

B.102. The updating of information on the prospects for nuclear power in developing countries will continue with the incorporation of data from planning studies and from programme information supplied by Member States.

B.103. There are encouraging signs that some manufacturers could make smaller power reactors available at reasonable capital costs through the adoption of new construction techniques. These developments will be reviewed in 1979 (Advisory Group - Annex II (9)) and 1980 (Advisory Group) in close co-ordination with the "Applications of low-temperature nuclear heat" component.

B.104. An exchange of developing countries' experience in the operation and maintenance of nuclear power plants is planned for 1979 (Seminar - Annex I (4)).

Plans for 1981-84

B.105. Advisory group or consultants' meetings will be held to the extent necessary for updating information on specific aspects of nuclear power plant demand and availability.

Economic and technical planning of nuclear power programmes

Objective

B.106. The objective is to assist developing countries in the optimization of their power programmes and, where appropriate, in the planning of nuclear power programmes.

Results to date

B.107. The models and computer programmes for the analysis and optimization of electric power expansion plans which were developed in 1971-72 in connection with the Market Survey for Nuclear Power in Developing Countries and later substantially improved have been released to 30 Member States and four international bodies (Economic Commission for Latin America, Economic and Social Commission for Asia and the Pacific, Inter-American Development Bank and IBRD), whose planning engineers and programme analysts were given training in accordance with their particular requirements during the period 1974-77.

B.108. Nuclear power planning studies were published for Bangladesh and Pakistan in 1975, for Indonesia in 1976 and for Hong Kong, Jamaica and Venezuela in 1977. A study for Peru was performed in 1977. Preliminary studies have been performed for Iran (1973), Uruguay (1977) and Panama (1977).

B.109. A guidebook entitled "Steps to Nuclear Power", designed to serve as a check list for authorities in developing countries which are considering the initiation of nuclear power programmes, was issued in the Agency's Technical Reports Series in 1975 and one entitled "Economic Evaluation of Bids for Nuclear Power Plants" was issued in the same publications series in 1976.

B.110. In view of the increasing importance of nuclear fuel availability, a guidebook on nuclear fuel procurement has been prepared for publication in 1978.

B.111. Two technical assistance projects were serviced and a number of fellowship applications evaluated during the period 1972-77.

B.112. Training in the use of the planning models and computer programs has been formalized in a series of courses, of which the first was held at Argonne National Laboratory, in February.

Plans for 1979-80

B.113. The planning models and computer programs will be reviewed in 1979 (Advisory Group - Annex II (10)) and 1980 (Advisory Group).

B.114. It is expected that nuclear power planning studies will be undertaken for three Member States during the 1979-80 period. A guidebook on the technical evaluation of bids for nuclear power plants will be published in 1979. Assistance in the economic analysis of various phases of nuclear power projects will be rendered to Member States on request. It will probably be necessary to depend very much on consultants for these activities, especially for the preparation of the technical bid evaluation guidebook.

Plans for 1981-84

B.115. Training in the use of the planning models and computer programs will continue to be provided, in line with the requirements of developing countries.

B.116. Nuclear power planning studies will be carried out on request, but it is expected that the number of requests will decrease as more countries acquire - through training and the transfer of the methodology by the Agency - the ability to carry out such studies themselves.

B.117. The guidebooks on the initiation of nuclear power programmes, on economic and technical bid evaluation and on nuclear fuel procurement will be periodically updated (possibly rewritten) to take into account the frequent changes expected in the contractual forms and conditions for the supply of nuclear power plants and provision of nuclear fuel cycle services.

B.118. Consideration will be given to the problems of financing nuclear power projects and associated fuel cycle facilities.

B.119. It is expected that during the 1981-84 period some activities will decline somewhat, exceptions being work on the updating of the planning models and computer programs and - possibly - financing studies.

Nuclear manpower development

Objective

B.120. The objective is to assess - and make Member States aware of - the manpower requirements for nuclear power programmes, to help requesting Member States in assessing their own manpower requirements and to provide comprehensive assistance to Member States in meeting them.

Results to date

B.121. This component is new, activities relating to nuclear manpower development having previously been included under the old component entitled "Nuclear power planning studies and guidelines for project implementation".

B.122. Of these activities, the nuclear power project training courses held within the framework of the Agency's technical assistance programme have involved the greatest effort. Four two-week nuclear power seminars (financed by UNDP) took place during the period 1973-77: in Thailand (1973), Jamaica (1975), the Philippines (1976) and the Republic of Korea (1977). They were attended by 134 participants.

B.123. Between September 1975 and the end of 1977, nine 15-week nuclear power project training courses (five with the emphasis on project planning and implementation and four with the emphasis on construction and operations management) were held at three host establishments: Kernforschungszentrum Karlsruhe, Argonne National Laboratory and Centre d'études nucléaires de Saclay. They were attended by 309 participants from 41 countries.

B.124. Arrangements have been made for the holding this year of two further nuclear power project training courses, a course on more general energy planning questions and five in-depth courses on selected subjects. In addition to the three above-mentioned establishments, the Spanish Junta de Energía Nuclear will be acting as host - for a course to be held in Madrid. An offer has been received also from the Soviet Union to host courses.

B.125. It is expected that by the end of 1978 nearly 700 people will have received training through the courses and seminars mentioned above.

B.126. A systematic assessment of nuclear manpower requirements for nuclear power programmes and the long-range integrated planning of nuclear manpower development were initiated in 1976 with a small UNDP-supported project to assess requirements in Brazil.

B.127. Estimates of nuclear manpower requirements for known nuclear power programmes in developing countries have been made and were presented at conferences held in 1975 and 1977.

B.128. In 1977, a major UNDP-supported nuclear manpower development project started in Brazil and pilot studies were initiated in Argentina and the Philippines (both pilot studies are expected to be concluded this year).

B.129. Work on building up the know-how necessary for the Agency to increase the effectiveness of its assistance to developing Member States in the planning and implementation of nuclear manpower development programmes is continuing.

B.130. An "International Inventory of Training Facilities in Nuclear Power and its Fuel Cycle" was issued in the "IAEA-" series of Agency publications in 1977.

B.131. Twelve technical assistance projects were serviced and a number of fellowship applications and reports evaluated during the period 1972-77.

Plans for 1979-80

B.132. The demonstrated need for the nuclear power project training courses and for an expanded programme of assistance in nuclear manpower development will be met through extensive co-operation between the Division of Nuclear Power and Reactors, the Division of Technical Assistance and - for courses relating to safety and regulatory activities - the Division of Nuclear Safety and Environmental Protection.

B.133. It is expected that about eight fairly general nuclear power project training courses will be held each year. As the need for general courses decreases, they will be replaced by courses in specialized fields where the type of training required by developing countries is not readily available from other sources. A tentative long-term programme of courses drawn up within the Secretariat includes the following specialized fields: the reviewing of safety analysis; radiological protection and waste management; regulatory planning and implementation; quality assurance; electricity system expansion planning; nuclear manpower development; the siting of nuclear power plants; uranium exploration; nuclear fuel cycle management (on the basis of non-domestic fuel cycle services); and safety and reliability in nuclear power plant operation.

B.134. In addition, it is planned to hold general courses on nuclear energy in the context of general energy planning about once every two years.

B.135. All nuclear power project training courses will include lectures and discussions concerning the need for qualified manpower. The results of the Agency's training programme will be examined periodically and plans for courses will be drawn up in detail for each year one to two years in advance. Assistance to Member States in arranging for on-the-job training will be increased in scope.

B.136. Recent information and experience concerning nuclear manpower requirements and development programmes will be exchanged and evaluated in 1979 (Symposium - Annex I (3); Advisory Group - Annex II (11)).

B.137. It is expected that advice on the long-term planning of nuclear manpower development will be requested. Advisory services will be provided through Agency missions to individual countries and it should be possible to meet two requests a year initially.

B.138. Several subjects will not lend themselves to treatment through interregional or regional courses; they include operating and maintenance problems, bid evaluation and certain aspects of contract negotiation. It is the intention to cover them at seminars conducted for individual countries by groups of experts which will normally include Agency staff members.

B.139. The preparation of guidelines on the training of and qualification requirements for various categories of nuclear power plant technician, including operating personnel and certain types of maintenance and support staff, will be initiated in 1979 (Advisory Group - Annex II (12)).

B.140. The "International Inventory of Training Facilities in Nuclear Power and its Fuel Cycle" will be expanded and updated. In addition, it is intended to start preparing in 1978 a guidebook on manpower development after sufficient information has been obtained from pilot studies and other sources (Advisory Group).

Related activities

B.141. Analyses of nuclear manpower requirements will be included in future nuclear power planning studies. When appropriate, special emphasis will be placed on manpower questions in the course of missions and projects relating to nuclear power.

Plans for 1981-84

B.142. It is expected that an increase in the number of nuclear power projects in developing Member States will give rise to a corresponding increase in the need for Agency assistance in the nuclear manpower development field. The Agency will endeavour to provide effective assistance to individual countries in the planning and implementation of integrated nuclear manpower development programmes and will continue to arrange for general and specialized training courses.

Co-operation with other organizations

B.143. The activities constituting this component will involve co-operation with WMO, the United Nations Centre for National Resources, Energy and Transport, NEA and CMEA.

Assistance with project-related activities and domestic infrastructure development

Objective

B.144. The objective is to provide guidance and advice to requesting Member States on activities related to nuclear power projects, on fuel supply and the provision of fuel cycle services and on the development of domestic project participation capabilities.

Results to date

B.145. During the period 1972-77, technical expertise was provided in support of four large UNDP projects (two in Chile, one in Argentina and one in Peru), each involving a considerable number of experts with different assignments, fellowships and equipment. In addition, over 20 Agency technical assistance projects were serviced (staff members from the Division of Nuclear Power and Reactors being sent on expert assignments in connection with three of them), and a large and increasing number of fellowship applications and reports evaluated.

B.146. The number of projects to be serviced has been increasing steadily and there has been a clear trend towards greater complexity.

B.147. A symposium on problems associated with the export of nuclear power plants has been organized by the Division of Nuclear Power and Reactors in co-operation with the Division of Nuclear Safety and Environmental Protection for this year and arrangements have been made for a seminar on domestic participation in nuclear power programmes.

Plans for 1979-80

B.148. It is expected that the number of requests for technical assistance in connection with nuclear power projects will increase. The provision of advisory services covering the various stages of nuclear power projects will continue, with the emphasis probably shifting from advice on planning to advice connected with such matters as the availability of reactor components, fuel cycle services and fuel, the reliability of supply sources, criteria for nuclear power plant proveness, and the establishment of domestic infrastructure.

B.149. Work on the preparation of manuals and guides concerning nuclear power project management will be initiated in 1980 (Advisory Group).

Plans for 1981-84

B.150. It is expected that the number of requests for advisory services will increase further, the emphasis shifting as the needs of requesting countries change.

Co-operation with other organizations

B.151. Co-operation with UNDP and with the regional economic commissions of the United Nations is expected to become even closer.

Technology of nuclear power plants of proven types

OBJECTIVE

B.152. The objective is to keep Member States abreast of the technological status of and operating experience with nuclear power plants of proven types used in electricity production or for other purposes by, in particular, distributing plant availability and component data and information on specific aspects of the use of low-temperature heat from nuclear power plants and to make recommendations regarding principles, methods and techniques to be applied in the design, construction and operation of nuclear power plants so as to achieve required levels of quality assurance and satisfactory performance of nuclear power plants in service.

PLANS FOR 1979-84

B.153. It is planned to continue the publication of annual reports on nuclear power plant operating experience. With the increasing number of nuclear power plants in operation, emphasis will be placed on the evaluation of plant availability and on determination of the main causes of plant outages with resulting unavailability. The evaluation results will be published in analytical reports on plant availability and in reports containing failure statistics for main plant systems.

B.154. Information on the technology of proven reactor systems will be collected through the activities of international working groups, whose recommendations will be disseminated through Agency and - occasionally - outside publications.

B.155. Activities relating to nuclear power plant quality assurance will consist largely in the preparation of safety guides under the NUSS programme. After preparation of the safety guides, attention will be directed to the formulation and issuing of recommendations - intended primarily for plant owners and operators - on procedures for quality verification in the course of nuclear power projects.

B.156. A continuation of the exchange and dissemination of information on direct applications of low-temperature nuclear heat, which are attracting more and more attention as means of achieving efficient energy utilization and saving fossil fuel, is envisaged.

STRUCTURE

B.157. This sub-programme consists of three components, which are described in the following paragraphs.

Technology of nuclear power plants of proven types

Summary by programme components

Table B. 7

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Nuclear power plant performance and quality assurance	2.0	0.6	122 200	-	-	2 800	125 000
Nuclear power plant systems reliability	2.2	0.8	132 800	16 200	15 000	4 000	168 000
Applications of low-temperature nuclear heat	1.0	0.6	59 400	5 400	-	2 200	67 000
Linguistic services	-	-	-	-	-	12 000	12 000
Printing and publishing services	-	-	-	-	-	100 000	100 000
Data processing services	-	-	-	-	-	30 000	30 000
TOTAL	5.2	2.0	314 400	21 600	15 000	151 000	502 000

Nuclear power plant performance and quality assurance

Objective

B.158. The objective is:

- (a) to collect, evaluate and publish annually data on nuclear power plant operating experience in Member States which will constitute an authoritative statement on power reactor performance and serve as information for the preparation of quality assurance programmes and engineering standards within the Agency and in Member States; and
- (b) to complete work on the international quality assurance code of practice and safety guides within the framework of the NUSS programme (1980) and to prepare additional, more operator-oriented guides on quality assurance (1982).

Results to date

B.159. Since 1970 a report entitled "Operating experience with nuclear power stations in Member States" has been published each year, and since 1974 it has been supplemented by a "Performance analysis report". A publication entitled "Power reactors in Member States" has been issued annually since 1975; it contains a computer-printout of general information on power reactors in Member States and also of information on plant systems which is intended for use in evaluating plant performance.

B.160. Most of the work on quality assurance has been carried out under the NUSS programme. A code of practice on quality assurance for safety in nuclear power plants was completed in 1977. Seven safety guides covering various aspects of quality assurance have been prepared by working groups and are in various stages of review and approval. In the area of quality assurance, nine technical assistance projects were serviced and a steadily increasing number of fellowship applications and reports evaluated during the period 1972-77.

Plans for 1979-80

B.161. "Operating experience with nuclear power stations in Member States" and the "Performance analysis report" will continue to be published each year, as will "Power reactors in Member States" (close co-operation with INIS is foreseen in respect of this publication). The format of the "Performance analysis report" will be revised as necessary in order to increase its usefulness.

B.162. As mentioned under the component "Survey of nuclear power applicability in developing countries", a seminar on the operation and maintenance of nuclear power plants in developing countries is planned for 1979.

B.163. It is planned to complete and issue ten to twelve safety guides concerned with quality assurance at all stages of a nuclear power project from design to operation and based to a large extent on the operating data, including outage statistics and information on causes of outages, compiled by the Agency. The safety guides will contain recommendations relating to quality assurance programme preparation, quality assurance organization and other aspects of the establishment and running of quality assurance systems and define the functions of quality assurance in design, procurement, construction and other nuclear power project activities. Three or four technical committee meetings in 1979 and 1980 are envisaged; funds will be provided under the "Nuclear Safety and Environmental Protection" programme.

B.164. In addition, plans will be drawn up for the preparation of manuals intended primarily for plant owners and operators and setting forth procedures to be followed in applying the code of practice and safety guides concerned with quality assurance.

B.165. The question of standardized designs for nuclear power plants will be considered in 1980 in the light of the importance of achieving higher plant efficiency (Symposium - Annex III (2)).

Related activities

B.166. It is expected that the number of requests for advisory services relating to quality assurance will increase. Quality assurance will be included in the programme of general training courses for nuclear power project personnel and specialized courses on quality assurance will be organized.

Plans for 1981-84

B.167. It is planned to continue publishing each year reports on operating experience with nuclear power stations and analytical reports on plant performance. With the increasing number of nuclear power plants in operation, more emphasis will be placed on analytical reports. The form of the annual reports may be changed, particularly as co-operation with other international organizations is intensified, one purpose of the changes being to stress the importance of quality assurance at all stages of nuclear power projects.

B.168. After completion of the safety guides concerned with quality assurance, this programme component will be oriented towards the formulation of quality assurance and quality control procedures recommended for application in various activities affecting the quality of nuclear power plants. These procedures will be published in the form of guides and manuals containing instructions based on analyses of plant operation data and of the causes of recorded component failures. Emphasis will be placed on the verification function of quality assurance and in particular on inspection, testing, auditing and other methods and procedures.

B.169. Periodic reviews of the safety guides concerned with quality assurance may be necessary.

Co-operation with other organizations

B.170. Co-operation in the collection of power reactor operating data has been established with CEC and in data evaluation with UNIPPEDE. It is possible that future work will call for co-operation with the World Energy Conference.

B.171. In matters relating to the NUSS programme, close co-operation has been established with international organizations such as WHO, ISO, CEC, CMEA and NEA.

Nuclear power plant systems reliability

Objective

B.172. The objective is to collect, evaluate and disseminate information on the principles, methods and techniques for achieving reliability in control and instrumentation and pressure vessel systems which will serve as a basis for the preparation of safety guides and engineering manuals.

Results to date

B.173. The International Working Group on the Reliability of Reactor Pressure Components (IWGRRPC) and the International Working Group on Nuclear Power Plant Control and Instrumentation (IWGNPPCI) were established in 1967 and 1970 respectively; since their establishment they have organized two or three specialists' meetings each year. In 1974 their activities were reviewed and oriented towards problems of more immediate interest to Member States, in particular those which are developing countries.

B.174. A symposium on the application of reliability technology to nuclear power plants (with emphasis on reliability problems of reactor pressure components) was held in 1977.

B.175. A co-ordinated research programme on the neutron irradiation embrittlement of pressure vessel steels was carried out during the period 1972-76; a research co-ordination meeting was held in 1974 and the report published in 1975 in the Agency's Technical Reports Series has been of international significance for standardization in materials testing. Following completion of the programme, a programme entitled "Analysis of the behaviour of advanced reactor pressure vessel steels under neutron irradiation" was established (Table B. 9, No. 2); the first co-ordination meeting was held in October 1977.

B.176. During the period 1972-77, forty-one technical assistance projects were serviced and a large number of fellowship applications and reports evaluated.

Plans for 1979-80

B.177. Through IWGRRPC and IWGNPPCI, the status of research and development work and engineering progress relevant to nuclear power plant systems and components will be reviewed in 1979 (Technical Committee - Annex II (13)) and 1980 (Technical Committees); specific technological topics will be the subject of specialists' meetings. Information on design principles, installation techniques and testing and operation procedures will be collected, evaluated and disseminated to Member States through publications (mainly in the "IAEA-" series) containing technical data and indicating requirements and preferred technical solutions for reactor vessels and other pressure-retaining components and for control and instrumentation systems.

B.178. Work will continue on the preparation of technical manuals concerning the reliability of reactor pressure components and control and instrumentation systems.

B.179. In accordance with the recommendations of IWGNPPCI, a co-ordinated research programme on flow measurement in large pipes will be initiated.

B.180. A second meeting within the framework of the co-ordinated research programme on the behaviour of advanced reactor pressure vessel steels under neutron irradiation will be held in 1979.

B.181. Water chemistry and corrosion problems of nuclear reactor systems and components will be reviewed in 1980 (Symposium - Annex III (3)).

Related activities

B.182. With developing countries showing more and more interest in reliability aspects of reactor control and instrumentation, of reactor pressure vessels and of other pressure-retaining components, and with the trend - reflected in a steady increase in the number of requests for experts and fellowships - expected to continue, several technical assistance projects relating to this field will be serviced.

Plans for 1981-84

B.183. Tentative plans have been made for a further symposium - in 1982 - dealing with the reliability of reactor pressure components and for a symposium - in 1983 - on reactor control and instrumentation.

Co-operation with other organizations

B.184. Close co-operation has been established and will be maintained with several organizations, including ISO, NEA, CEC, CMEA, the International Council for Pressure Vessel Technology, the International Institute of Welding and the International Electrotechnical Commission.

Applications of low-temperature nuclear heat

Objective

B.185. The objective is to review continuously the status of and developments in the use of low-temperature heat from power reactors of proven types in industry, desalting and district heating with a view to promoting projects through information exchange and to assessing the potential role of nuclear heat applications.

Results to date

B.186. The activities constituting this component were initiated during the period 1963-65 under components entitled "Nuclear desalination" and "Multipurpose applications". The component in its present form was constituted in 1974, since when aspects of nuclear heat utilization such as district heating and the desalination of sea-water have been reviewed; the proceedings of an advisory group meeting on district heating have been published in the Agency's Panel Proceedings Series and a publication on desalination is to appear soon. A request for technical assistance relating to industrial complexes based on nuclear heat was evaluated in 1977.

Plans for 1979-80

B.187. The possibility of using low-temperature heat from nuclear reactors is arousing more and more interest in Member States. However, a number of problems must be solved before major projects can be implemented. As a contribution to the solution of some of these problems, the question of costing heat from nuclear power plants will be reviewed in 1979 (Technical Committee - Annex II (14)) and safety aspects of the utilization of heat from nuclear reactors in 1980 (Technical Committee).

Plans for 1981-84

B.188. The scope of this programme component will be adapted to meet the changing requirements of Member States.

Co-operation with other organizations

B.189. Close co-operation will be maintained with the United Nations Economic Commission for Europe, which is launching a programme on the dual-purpose utilization of thermal power plants.

Advanced nuclear power technology

OBJECTIVE

B.190. The objective is to foster information exchange and other forms of collaboration among Member States engaged in the development of advanced nuclear reactor, fuel cycle and energy conversion systems in cases where international co-operation is desirable owing to the scale of the technological effort and capital investment involved in developing a system and bringing it to commercial maturity.

PLANS FOR 1979-84

B.191. Emphasis will continue to be placed on breeder reactor and high-temperature reactor (HTR) development in view of the large technological effort being directed to it and the benefits to be derived from continuing international co-operation in this area.

B.192. Account will be taken of the results of INFCE and of Member States' expressions of interest in alternative or advanced nuclear reactor and fuel cycle systems which could benefit from international co-operation.

B.193. Account will also be taken of the increasing emphasis in controlled thermonuclear fusion research on technological aspects of fusion reactor development and of the continuing progress in advanced energy conversion systems research and development.

B.194. Activities relating to technological applications of reactor and radiation physics will continue, with increasing emphasis on assisting developing countries which have plans to embark on nuclear power programmes.

STRUCTURE

B.195. This sub-programme consists of four components, which are described in the following paragraphs.

Advanced nuclear power technology

Summary by programme components

Table B. 8

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
New power reactor technology	1.8	1.0	105 600	18 200	-	2 200	126 000
Advanced reactor and fuel cycle concepts	1.6	1.4	103 500	7 200	12 000	2 300	125 000
Application of reactor and radiation physics to reactor technology	0.5	0.3	28 100	42 400	28 000	500	99 000
Advanced energy conversion	0.3	0.3	20 000	13 000	-	-	33 000
Linguistic services	-	-	-	-	-	16 000	16 000
Printing and publishing services	-	-	-	-	-	70 000	70 000
TOTAL	4.2	3.0	257 200	80 800	40 000	91 000	469 000

New power reactor technology

Objective

B.196. The objective is to assist, by means of international working groups, the leaders of national fast breeder and HTR programmes in the co-ordination of research efforts through information exchange.

Results to date

B.197. This programme component was initiated in 1968 with a symposium on advanced and high-temperature gas-cooled reactors and with the establishment of the International Working Group on Fast Reactors (IWGFR), which is composed of representatives of Member States with large development programmes in the field of fast breeder reactor technology and which meets annually to exchange information on the status of national programmes and to review and make recommendations on the Agency's activities in the fast reactor field.

B.198. Under the auspices of IWGFR, topics such as leak detection and location in LMFBR steam generators, sodium removal, component decontamination, sodium fires and their prevention and flow-induced vibrations have been examined. Several technical documents have been published, including "Profiles of facilities used for FBR research and testing" and "LMFBR plant parameters". The IWGFR assisted in the technical preparations for the International Symposium on Design, Construction and Operating Experience of Demonstration Liquid Metal Fast Breeder Reactors, which was held in April.

B.199. In 1975, a symposium on gas-cooled reactors, with emphasis on advanced systems, showed that many countries were still interested in the eventual full development of the HTR concept, including exploitation of the thorium fuel cycle. Meetings to review progress in HTR development programmes were held in 1976 and 1977, and preparations have been made for the establishment, this year, of an international working group on HTRs composed of representatives of Member States with large development programmes in the field of gas-cooled HTRs.

Plans for 1979-80

B.200. Annual meetings of IWGFR will be held in 1979 (Technical Committee - Annex II (15)) and 1980 (Technical Committee); in addition, topics recommended by IWGFR will be discussed at specialists' meetings. Steps will be taken to encourage the development of a common safety approach for LMFBRs through an intercomparison of safety design criteria; this would help later in the preparation of safety codes and guides for LMFBRs.

B.201. Annual meetings of the international working group on HTRs will be held in 1979 (Technical Committee - Annex II (16)) and 1980 (Technical Committee); in addition, topics recommended by the international working group will be discussed at specialists' meetings.

Related activities

B.202. Publication activities will continue, with both international working groups issuing technical documents and review papers.

Plans for 1981-84

B.203. Activities relating to fast breeder reactors and HTRs will continue through annual meetings of the two international working groups and specialists' meetings. Depending on progress achieved, a symposium on prototype and demonstration HTR power plant design, construction and operating experience may be proposed for 1981 or 1982.

Co-operation with other organizations

B.204. Co-operation with NEA and CEC will continue.

Advanced reactor and fuel cycle concepts

Objective

B.205. The objective is to promote the exchange of information on projects relating to the technological assessment and development of advanced reactor and fuel cycle concepts, thermal and fast reactors with improved nuclear fuel utilization characteristics, fusion reactors and test facilities for advanced research.

Results to date

B.206. In the field of advanced thermal reactors, the status and prospects of thermal breeder and near-breeder reactors was reviewed by consultants during the period 1975-78. In the field of advanced fast reactors, a study group on gas-cooled fast breeders met in 1972 to review the reactor design studies and supporting research efforts under way in various countries. In the field of fusion reactor development, a workshop on fusion reactor design problems was held in 1974, a technical committee on design aspects of large-scale Tokamak experiments was convened in 1975 and a technical committee and workshop on fusion reactor design was held in 1977.

Plans for 1979-80

B.207. Account will be taken of the results of INFCE, and recommendations for Agency action in helping to promote international co-operation in the field of alternative nuclear fuel cycle concepts will be formulated in 1980 (Advisory Group). It is expected that emphasis will be placed on the development of proliferation-resistant fuel cycle concepts and on improved nuclear fuel utilization through the use of thorium in thermal and fast reactors.

B.208. In response to the increased awareness of the potential importance - in the long term - of utilizing nuclear fission for non-electrical energy generation, work on applications of high-temperature nuclear process heat in chemical and metallurgical processes will be

intensified. In 1979, information will be exchanged on materials suitable for advanced nuclear applications (Technical Committee - Annex II (17)), and in 1980 the development of the steam gasification and hydrogasification of coal using nuclear heat will be reviewed (Technical Committee).

B.209. A further review of fusion reactor technology and conceptual fusion reactor design, prepared with the help of consultants in 1979, will take place in 1980 (Technical Committee).

Related activities

B.210. Developments in fuel cycle technology for alternative and advanced nuclear reactors will be considered under the sub-programme "Nuclear raw material resources assessment and development and fuel cycle technologies". Fusion development with emphasis on plasma physics will be considered under the "Physics" sub-programme of the "Physical sciences" programme.

Plans for 1981-84

B.211. Activities aimed at an international exchange of information on programmes for developing proliferation-resistant nuclear reactor and fuel cycle systems will be intensified. Technological developments in connection with advanced thermal and fast reactors, nuclear process heat applications and fusion reactors will be monitored and information exchange meetings will be held when they are considered timely.

Co-operation with other organizations

B.212. There will be continued co-operation with NEA in the field of gas-cooled fast breeder development.

Application of reactor and radiation physics to reactor technology

Objective

B.213. The objective is to foster the dissemination of information on experimental and analytical techniques and of related calculational methods for the prediction and interpretation of reactor behaviour and for the analysis of fuel burn-up data, radiation shielding studies, dosimetry results and studies of the effects of radiation on reactor materials.

Results to date

B.214. Agency activities in this field have included a seminar on numerical reactor calculations (1972), a review course on burn-up physics (1974) and meetings - held jointly with NEA - on sensitivity studies and shielding benchmarks (1975) and nuclear data requirements for shielding calculations (1976 and 1978). A review by consultants in 1977 resulted in recommendations which included one concerning the holding of a technical committee on homogenization methods in reactor physics in 1978. The International Working Group on Reactor Radiation Measurements (IWGRRM), established in 1971, has organized specialists' meetings on selected topics including radiation damage units (1972 and 1976) and neutron spectrum unfolding (1977) and has supported several research projects in the field of reactor dosimetry.

B.215. A co-ordinated research programme on fuel burn-up calculations and experiments for thermal reactors ran from 1971 to 1976. A co-ordinated research programme on neutron transport theory and advanced reactor calculations was established in 1972 and renewed in 1976 (Table B.9, No. 1). Under this programme, different methods and computer codes for advanced reactor calculations have been tested through interlaboratory comparisons of solutions to benchmark problems.

B.216. Thirteen technical assistance projects were serviced and a number of fellowship applications and reports evaluated during the period 1972-77.

B.217. An advanced review course on reactor theory and power reactors, for reactor physicists from developing countries, was organized in co-operation with the International Centre for Theoretical Physics and took place early this year.

Plans for 1979-80

B.218. The field of fast reactor physics, especially physics design problems of large fast breeder reactors, will be examined in 1979 (Symposium - Annex I (5)). There will be reviews of the state of the art in interpreting in-core physics measurements in 1979 (Technical Committee - Annex II (18)) and of developments in multidimensional kinetics and shielding physics in 1980 (Technical Committees), in co-operation with NEA. IWGRRM will hold annual meetings in 1979 (Technical Committee - Annex II (19)) and 1980 (Technical Committee); at specialists' meetings, increased emphasis will be placed on areas of interest to countries embarking on nuclear power programmes.

Related activities

B.219. The results of the co-ordinated research programme on neutron transport theory and advanced reactor calculations will be reviewed in 1979. IWGRRM will continue to review work done under the "Physical sciences" programme relating to activation techniques and nuclear data for dosimetry.

B.220. Assistance will be given in the organization of an extended seminar for reactor physicists from developing countries which it is planned to hold at the International Centre for Theoretical Physics in 1980.

Plans for 1981-84

B.221. A symposium on numerical reactor calculations may be proposed for 1981 or 1982. Assistance may be given in organizing a follow-up extended seminar for reactor physicists from developing countries contemplated for 1982 or 1983.

Co-operation with other organizations

B.222. Co-operation with NEA's Committee on Reactor Physics will be maintained for all activities in the reactor physics and shielding physics fields, the Agency emphasizing the needs of developing countries.

Advanced energy conversion

Objective

B.223. The objective is to provide for international co-operation and information exchange in connection with new developments in the field of advanced energy conversion concepts, including the use of magnetohydrodynamics (MHD) for electrical power generation.

Results to date

B.224. The Joint NEA/IAEA International Liaison Group on MHD Electrical Power Generation (ILGMHD) was established in 1966; UNESCO replaced NEA as co-sponsor in 1976. The group has provided a useful international forum for periodic exchanges of information on national programmes and for international collaboration. Six international symposia on MHD electrical power generation have been held with the support of the Agency and NEA. Status reports on work in the MHD field have been prepared periodically by ILGMHD; the latest one, issued in 1977, covers results obtained in work on open-cycle, closed-cycle plasma and closed-cycle liquid metal MHD electrical power generation. Meetings of specialists on closed-cycle MHD technology have been held annually.

Plans for 1979-80

B.225. ILGMHD will meet in 1979 (Technical Committee - Annex II (20)) and 1980 (Technical Committee) to report on and evaluate new technological developments and experience gained in the operation of experimental and prototype plants. The seventh international symposium on MHD electrical power generation is planned for 1979; it will be supported financially by UNESCO and the Agency.

B.226. Progress in the development of other advanced energy conversion systems, including hydrogen production by the thermochemical splitting of water using nuclear heat, will be monitored for the purpose of determining in which areas international information exchange could be usefully encouraged.

Plans for 1981-84

B.227. ILGMHD will meet annually and a further international symposium will be held in 1983 if deemed appropriate in the light of the progress being made. More attention will be paid to hydrogen production using nuclear heat if warranted by technological developments.

Co-operation with other organizations

B.228. Co-operation with UNESCO in the sponsorship of ILGMHD will continue.

Co-ordinated research programmes

Table B.9

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
1. Neutron transport theory and advanced reactor calculations	2	8	1976	1979
2. Behaviour of advanced reactor pressure vessel steels	1	7	1977	1982
3. Bacterial leaching of uranium ores	5	3	1972	1978
4. Factors controlling ore formation in sandstone-type uranium deposits	3	-	1976	1981
5. Study of granitic rocks as a source of uranium	This programme has been approved but no contract has yet been awarded.			

C. NUCLEAR SAFETY AND ENVIRONMENTAL PROTECTION

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table C. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	1 432 377	1 596 000	112 000	33 000	145 000	1 741 000	2 038 000
Consultants	118 233	218 000	10 500	(55 500)	(45 000)	173 000	197 000
Overtime	8 417	14 100	800	(1 200)	(400)	13 700	15 000
Temporary assistance	4 585	2 900	200	(200)	-	2 900	3 000
Sub-total	1 563 612	1 831 000	123 500	(23 900)	99 600	1 930 600	2 253 000
Common staff costs	395 806	462 300	16 100	7 200	23 300	485 600	560 800
Travel	83 691	105 000	7 400	(15 400)	(8 000)	97 000	122 000
Meetings							
Conferences, symposia, seminars	77 838	121 000	3 000	8 000	11 000	132 000	117 000
Technical committees, advisory groups	465 328	724 000	28 000	30 000	58 000	782 000	800 000
Representation and hospitality	12 355	12 700	800	(100)	700	13 400	16 300
Scientific and technical contracts	217 947	310 000	16 000	(14 000)	2 000	312 000	407 000
Scientific supplies and equipment	13 773	16 000	1 300	17 500	18 800	34 800	29 300
Common services, supplies and equipment	44 489	5 000	400	(4 800)	(4 400)	600	35 600
Transfer of costs:							
Linguistic services	296 020	244 000	13 000	1 000	14 000	258 000	298 000
Printing and publishing services	276 352	356 000	20 000	59 000	79 000	435 000	445 000
Data processing services	5 317	-	-	6 000	6 000	6 000	8 000
To other PNE	(28 000)	(33 000)	(2 000)	-	(2 000)	(35 000)	(38 000)
TOTAL	3 424 528	4 154 000	227 500	70 500	298 000	4 452 000	5 054 000

SUMMARY OF MANPOWER

Table C. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
D	1	1	1	-	1	1
P-5	16	16	16	-	16	16
P-4	14	14	14	2	16	20
P-3	3	3	3	-	3	3
Sub-total	34	34	34	2	36	40
GS	25	25	25	-	25	28
TOTAL	59	59	59	2	61	68

CHANGES IN COSTS AND MANPOWER

Costs

- C.1. As will be seen from Table C.1 above, the cost of this programme is expected to increase by \$298 000 as a result of price increases of \$227 500 and a programme increase of \$70 500.
- C.2. A programme increase of \$40 200 in respect of salaries for established posts and common staff costs reflects the cost of two additional P-4 posts and the offsetting effect of delayed recruitment of new staff to replace departing staff members. A reduction of \$55 500 will be possible in respect of consultants' services mainly in the "Waste management" sub-programme and there will be a reduction of \$1400 in respect of overtime and temporary assistance.
- C.3. A programme decrease of \$15 400 in respect of duty travel is foreseen affecting all three sub-programmes.
- C.4. It is planned to hold four symposia and seminars in 1979, the same number as foreseen in the 1978 budget; the programme increase of \$8000 is attributable to financial participation in international meetings of other organizations. The programme increase of \$30 000 in respect of technical committees and advisory groups is attributable to an increase in the number of meetings from 48 in the 1978 budget to 51 in the 1979 estimates. Two of the three additional meetings are Technical Review Committee meetings connected with the NUSS programme.
- C.5. A programme decrease of \$14 000 is foreseen in respect of scientific and technical contracts. The increase of \$17 500 in respect of scientific supplies and equipment is required for the acquisition of additional health physics equipment for use in the Agency's Laboratory (including the Safeguards Analytical Laboratory) and of additional equipment for personal monitoring of safeguards inspectors. A reduction of \$4800 will be possible in respect of common services, supplies and equipment. As regards the allocation of service costs, the increases in respect of linguistic services (\$1000) and printing and publishing services (\$59 000) are required mainly in connection with the preparation of safety codes and guides. Funds needed for data processing services will increase by \$6000.
- C.6. It is expected that \$120 000 will be available from UNEP for the financing of a multi-agency programme relating to the Convention for Protection of the Mediterranean Sea against Pollution (the Barcelona Convention). An amount of \$55 000 will be contributed by the Government of the United States towards the joint IAEA/IIASA risk assessment project.

Manpower

- C.7. As will be seen from Table C.2 above, the addition of two Professional posts at the P-4 level is foreseen for 1979. Detailed justifications are provided in Annex V.
- C.8. For 1980, the addition of four Professional and three GS posts will be required: two P-4 posts and one GS post for the "Nuclear safety" sub-programme, to support technical assistance activities; one P-4 post and one GS post for the "Waste management" sub-programme, mainly to prepare guidelines relevant to underground disposal of radioactive wastes; and one P-4 post and one GS post for the expansion of assistance to Member States in the adaptation and implementation of the Agency's transport regulations.

THE PROGRAMME

OBJECTIVE

C. 9. The objective is to ensure the safe utilization of nuclear energy and the protection of man and his environment from the harmful effects of nuclear radiation and radioactive and non-radioactive releases from nuclear facilities.

STRUCTURE

C. 10. This programme consists of three sub-programmes, which are dealt with separately below.

Summary of manpower and costs by sub-programme

Table C. 3

Sub-programme	1979 Estimate			1980 Preliminary estimate		
	Man-years		Costs	Man-years		Costs
	P	GS		P	GS	
Radiological safety	14.7	12.4	1 658 000	15.7	13.4	1 729 000
Waste management	9.9	6.3	1 255 000	10.9	7.3	1 439 000
Nuclear safety	11.4	6.3	1 539 000	13.4	7.3	1 886 000
TOTAL	36.0	25.0	4 452 000	40.0	28.0	5 054 000

SUB - PROGRAMMES

Radiological safety

OBJECTIVE

C. 11. The objective is to assist - through the provision of standards, recommendations, guidance and practical assistance - in the further development and harmonization, within Member States, of practices for the protection of workers and the general public against harmful effects of ionizing radiation arising in the peaceful utilization of atomic energy and to provide effective radiological protection services in connection with Agency activities or Agency-assisted activities.

PLANS FOR 1979-84

C. 12. Work will continue on:

- (a) The preparation and updating of standards, recommendations and guidance for the radiological protection of workers and the general public;
- (b) The dissemination of information on radiation protection methods, procedures and instrumentation;
- (c) The provision of assistance to Member States in applying and implementing the Agency's radiological safety standards and recommendations and in training their specialists and technicians;
- (d) Risk assessment and its relationship to decision-making;
- (e) The promotion and co-ordination of research related to radiological protection; and

- (f) The provision of radiological protection services for the Agency's own operations and for Agency-assisted operations.

C. 13. The gradual shift in emphasis during recent years from the first to the other five topics listed above is expected to continue, but existing standards and recommendations will be reviewed and brought into conformity with the latest recommendations of ICRP. Standards will also be developed in new areas as the need arises. Where appropriate, efforts will be made to secure the preparation and endorsement of standards and recommendations jointly with other competent international organizations, in particular WHO. Efforts will also be made to ensure the harmonization of Agency standards with other international standards and to encourage Member States to adopt them to the greatest possible extent.

C. 14. In response to the recommendations of an advisory group, work on the safe transport of radioactive materials will be expanded significantly, with the aim of assisting Member States in the effective application of internationally agreed regulations to the increased traffic in irradiated fuel and other highly radioactive substances and of ensuring compatibility between the measures for ensuring safety and those for ensuring physical protection during the transport of nuclear materials.

C. 15. Activities directly related to the development of nuclear power programmes will continue to grow and the provision of radiological protection services for the increasing number of Agency safeguards inspectors, for the Safeguards Analytical Laboratory and other Agency laboratories and for technical assistance experts will continue.

STRUCTURE

C. 16. This sub-programme consists of six components, which are described in the following paragraphs.

Radiological safety

Summary by programme components

Table C. 4

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Radiological protection of workers	3.4	1.7	194 200	221 000	60 000	9 800	485 000
Radiological protection of the general public	2.6	1.4	152 600	70 000	60 000	13 400	296 000
Safe transport of radioactive materials	2.3	1.5	151 300	50 000	30 000	3 700	235 000
Risk assessment research (joint IAEA/IIASA project)	2.3	4.0	166 500	-	15 000	3 500	185 000
Radiological protection services for the Agency's own operations and for Agency-assisted operations	3.3	3.3	218 500	-	-	29 500	248 000
Emergency assistance with regard to radiation accidents	0.8	0.5	45 000	-	-	5 000	50 000
Linguistic services	-	-	-	-	-	43 000	43 000
Printing and publishing services	-	-	-	-	-	145 000	145 000
Data processing services	-	-	-	-	-	6 000	6 000
Transfers to other programmes for direct support	-	-	-	-	-	(35 000)	(35 000)
TOTAL	14.7	12.4	928 100	341 000	165 000	223 900	1 658 000

Radiological protection of workers

Objective

C. 17. The objective is to provide standards, recommendations and guidance - related to the design and operation of facilities and to physical and medical surveillance in normal and emergency situations - on the radiological protection of occupationally exposed persons and to provide guidance on the assessment of individual and collective occupational exposure.

Results to date

C. 18. This component was initiated in 1958. Standards and recommendations have been issued on dose limitation, on the organization of radiation protection programmes, on radiological safety features of the design and operation of facilities (including uranium and thorium mines and mills, nuclear fuel fabrication plants, power reactors and hot laboratories), on the physical and medical surveillance of workers and on emergency plans and procedures.

C. 19. During the period 1972-77, the proceedings of four symposia were published and several volumes were issued in the Agency's Safety Series (Safe Handling of Plutonium - No. 39; Radiation Protection Procedures - No. 38; Safe Use of Radioactive Tracers in Industrial Processes - No. 40; Safe Handling of Radionuclides (1973 edition) - No. 1; Radiological Safety Aspects of the Operation of Neutron Generators - No. 42) and Technical Reports Series. Four training courses and six regional seminars included the radiological protection of workers as substantial parts of their programmes. Lectures were given at training courses arranged under other Agency programmes, including the courses on nuclear power project planning and implementation, and by other international organizations. A co-ordinated research and intercomparison programme on nuclear accident dosimetry systems was completed and a co-ordinated research programme was started on the use of cell membrane probes as biological indicators in cases of accidental exposure to radiation (Table C. 7, No. 6). Preparations were made for the start of a co-ordinated research programme on the practical application of chromosome analysis in radiation protection.

C. 20. In 1976, a study was initiated, in co-operation with UNSCEAR and NEA, on the assessment of individual and collective occupational exposure in nuclear programmes throughout the world. The Basic Safety Standards for Radiation Protection and the Code of Practice on Basic Requirements for Personnel Monitoring were revised in 1977 to take account of the new recommendations of ICRP issued that year.

Plans for 1979-80

C. 21. The study on occupational exposure will continue and in 1979 nuclear fuel cycle facility operating experience will be reviewed in co-operation with NEA (Symposium - Annex I (6)) for the purpose of identifying those operations in which the highest occupational doses have been received; in 1980, the available information will be examined in an attempt to identify those operations which lead to the highest occupational exposures and with a view to suggesting measures for reducing the doses received (Advisory Group).

C. 22. Problems of making occupational exposures as low as is reasonably achievable will be discussed at a meeting organized for the benefit of countries in the Mediterranean and Middle East region (Seminar - Annex I (9)). Also in 1979, a manual on the practical implementation of physical and medical surveillance programmes for occupationally exposed persons will be prepared taking into account the most recent ICRP recommendations (Advisory Group - Annex II (28)) and the implications of the recommendations for the Agency's safety standards and guides will be examined (Seminar - Annex I (7)).

C. 23. The Code of Practice on the Provision of Radiological Protection Services (Safety Series No. 13) will be revised in 1980 (Advisory Group). A study will be made in 1979 of procedures for optimizing radiological protection through the application of cost-benefit analysis to practical situations (Advisory Group - Annex II (29)).

C. 24. In order to assist developing Member States which are embarking on the production and use of radioisotopes, a manual will be prepared in 1980 on radiological safety aspects of the design and equipment of radioisotope laboratories (Advisory Group). The existing manual on safety aspects of the design and equipment of hot laboratories (Safety Series No. 30) will be revised in 1979 (Advisory Group - Annex II (31)).

C. 25. Increased attention will be paid to criticality safety aspects of the handling of fissile materials. Guidance will be prepared in 1979 on criticality alarm systems (Technical Committee - Annex II(21)) and in 1980 on criticality control and radiological protection for intermediate quantities of fissile materials (Advisory Group).

C. 26. The preparation of guidance on radiological protection services for nuclear fuel reprocessing plants will be completed in 1979 (Advisory Group - Annex II (24)). In the light of current technological proposals for thermonuclear fusion power generation, a preliminary study will be made in 1979 of the radiological safety aspects of fusion reactors (Advisory Group - Annex II (30)).

C. 27. With the help of consultants, recommendations will be prepared in 1979 on fire protection and fire fighting in nuclear facilities, on the preparation of safety analysis reports and on radiological safety aspects of the operation of proton accelerators. Also in 1979, the compendium of neutron spectra for nuclear accident dosimetry will be reviewed and extended. In 1980, the Code of Practice on the Safe Handling of Radionuclides (Safety Series No. 1) will be revised in the light of the new ICRP recommendations and the manuals on the medical supervision of radiation workers (Safety Series No. 25) and on radiation protection procedures (Safety Series No. 38) will be brought up to date.

C. 28. A group of experts will be convened in 1979 for the purpose of identifying problem areas in and advising the Agency on its programme on applied radiological protection for occupationally exposed persons in the nuclear industry (Advisory Group - Annex II (25)).

Related activities

C. 29. Subject to the availability of funds, regional training courses and regional seminars dealing - among other things - with first aid and early medical treatment following the accidental overexposure of workers will be organized when appropriate. Research on topics such as body monitoring for incorporated plutonium and the practical application of chromosome analysis in radiation protection will be supported.

Plans for 1981-84

C. 30. Attention will continue to be paid to the identification of operations and practices which lead to higher occupational exposure values and encouragement will be given to all investigations aimed at reducing individual and collective doses to levels as low as is reasonably achievable. Standards and recommendations will be brought up to date whenever it is necessary and account will be taken of the recommendations of the advisory group convened in 1979 to advise on the Agency's future programme in this area.

Co-operation with other organizations

C. 31. Co-operation will be maintained with ILO, WHO, UNSCEAR, ICRP, NEA and CMEA.

Radiological protection of the general public

Objective

C. 32. The objective is to provide standards, recommendations and guidance - related to the design and operation of facilities, to effluent monitoring and environmental surveillance and to emergency measures - on the radiological protection of the general public and to provide guidance on assessing the exposure of the public.

Results to date

C. 33. This component was initiated in 1958. Standards, recommendations and guidance have been published on dose limitation for members of the public, on the organization of radiation protection programmes, on the establishment of authorized limits for releases of radioactive materials into the environment, on effluent and environmental monitoring programmes, on off-site emergency response and on the handling of accidents which might involve exposure of the public to radiation.

C. 34. During the period 1972-1977 the proceedings of three symposia and seminars were published and several volumes were issued in the Agency's Safety Series (Objectives and Design of Environmental Monitoring Programmes for Radioactive Contaminants - No. 41; Manual on Radiological Safety in Uranium Mines and Mills - No. 43) and Technical Reports Series. Four training courses and six regional seminars included radiological protection of the general public as substantial parts of their programmes. Lectures were given at training courses arranged under other Agency programmes, including the course on nuclear power project planning and implementation, and by other international organizations. Co-ordinated research programmes on environmental monitoring for radiation protection purposes have been organized in collaboration with institutes in South East Asia and Latin America (Table C. 7, Nos 7 and 9). A programme of co-operation in radiological safety matters between countries in the Danube catchment area has been initiated and a co-ordinated research programme on the radioecology of the Danube is under way (Table C. 7, No. 8).

Plans for 1979-80

C. 35. In 1979, work will continue (in collaboration with the "Waste management" sub-programme) on procedures for establishing authorized limits for releases of airborne and liquid radioactive contaminants into the environment (Advisory Group - Annex II (23)) and, if possible, for setting agreed limits for acceptable residual levels of contamination of premises and articles after the decommissioning of nuclear facilities.

C. 36. Attention will be paid in 1980 to the question of agreed collective dose limits for sources of exposure not under national or regional control (Technical Committee).

C. 37. Mutual co-operation on questions of radiological safety between countries in the Danube catchment area will be discussed again in 1980 (Advisory Group) and the co-ordinated research programme on the radioecology of the Danube will be expanded. An attempt will be made to initiate similar co-operation between countries bordering on the Baltic Sea.

C. 38. Increasing attention is being paid to the monitoring and control of releases of carbon-14 from nuclear facilities, and it is planned to organize a meeting in 1979, in collaboration with the "Waste management" sub-programme, to study the technical features of that subject (Technical Committee - Annex II (22)).

C. 39. With the help of consultants, manuals will be prepared on the safe use of radiation sources and radioactive materials in agricultural investigations. Also studies will be made of the contributions of various activities involved in the operation of nuclear facilities and in the management of radioactivity to the collective dose of the population.

Related activities

C. 40. Subject to the availability of funds, regional training courses and study tours covering the radiological protection of the public and, in particular, the handling of emergency situations will be organized.

Plans for 1981-84

C. 41. Attention will continue to be paid to the practical application of the principles for establishing limits for releases of radioactive materials to the environment. Special consideration will be given to problems of international concern arising from the release of

radioactive materials which can become distributed globally and from the siting of facilities close to national boundaries or on international rivers or seas.

Co-operation with other organizations

C. 42. This component involves co-operation with WHO, FAO, UNEP, UNSCEAR, ICRP and NEA.

Safe transport of radioactive materials

Objective

C. 43. The objective is to provide standards and recommendations which can be used in formulating international and national regulations for the safe transport of radioactive materials and to advise and assist Member States and international organizations in connection with the effective application of such regulations.

Results to date

C. 44. This component was initiated in 1958. It was for many years concerned primarily with establishing and keeping up to date a set of comprehensive regulations and with encouraging their adoption by international transport organizations and individual Member States. With the completion of a major review of the regulations which resulted in the publication of a revised text ("Regulations for the Safe Transport of Radioactive Materials" - 1973 Revised Edition; Safety Series No. 6), further work on the safe transport of radioactive materials was done under the old component entitled "Radiological safety standards". In line with the recommendations of an advisory group convened in 1977, an expanded programme designed primarily for assisting Member States and international organizations in the effective application of the regulations has been formulated and the component entitled "Safe transport of radioactive materials" has been reintroduced.

C. 45. Advisory material on the application of the regulations (Safety Series No. 37) was issued in 1973 and a number of changes of detail in the regulations were promulgated in 1977. The proceedings of an international seminar on transport packaging for radioactive materials were published in 1976. In 1977, a standing advisory group on the safe transport of radioactive materials was established to assist the Agency in keeping the interpretation and implementation of the regulations under review and in evaluating and - when appropriate - revising them. Also in 1977, an initial compilation was made of data on transport accidents and on risk assessments performed in Member States and, on the basis of these data, an advisory group carried out a preliminary study of the adequacy of the existing package test requirements.

Plans for 1979-80

C. 46. The Standing Advisory Group on the Safe Transport of Radioactive Materials will meet in 1980 (Technical Committee) to advise on preparations for the next comprehensive revision of the Agency's regulations, which is provisionally planned for the early 1980s.

C. 47. In 1979, the review of transport accidents and risk assessments will continue with the aim of ascertaining whether the existing package test requirements are still adequate (Advisory Group - Annex II (26)) and a start will be made on a programme for encouraging and co-ordinating research and development work in Member States on transport casks and other aspects of nuclear transport technology (Advisory Group - Annex II (27)).

C. 48. With the help of consultants, guidance will be prepared on the standardization of quality and compliance assurance procedures related to the application of the transport regulations. Efforts will be made to allay undue public concern about the transport of radioactive materials through the publication of periodic reports on the world-wide transport situation and the issuing of material explaining the reasons behind various provisions in the regulations and indicating the level of safety which has been achieved.

C. 49. Attention will be paid to the need for ensuring compatibility between safety and physical protection during the transport and associated storage of nuclear materials. Also, consideration will be given to measures for minimizing the effects of residual activity in spent fuel storage ponds on the levels of surface contamination on transport casks.

C. 50. Owing to the expansion of work on the safe transport of radioactive materials, one additional Professional post (at the P-4 level) will be required in 1979 - see Table C.2 and Annex V. In 1980, one additional post at the P-4 level and one additional GS post will be needed.

Related activities

C. 51. Agency staff will to an increasing extent attend meetings of other international organizations with transport regulation functions in order to ensure that provisions for consignments of radioactive materials continue to be uniform for all modes of transport.

C. 52. Advisory services will continue to be provided, on request, in matters related to the safe transport of radioactive materials.

Plans for 1981-84

C. 53. Work will continue along the same general lines, account being taken of the advice given by the Standing Advisory Group on the Safe Transport of Radioactive Materials. Emphasis will be placed on assisting Member States to formulate and implement adequate quality and compliance assurance programmes. Preparations will be made for the next comprehensive revision of the Agency's regulations.

Co-operation with other organizations

C. 54. Co-operation will be maintained with WHO, ICAO, IMCO, UPU, CEC, ECE, ICRP, ISO, CMEA, NEA, IATA and the Central Office for International Railway Traffic.

Risk assessment research (joint IAEA/IIASA project)

Objective

C. 55. The objective is to facilitate the co-ordination of risk assessment research methodologies in the following areas: estimation of the physical and environmental risks of energy systems; risk evaluation techniques to identify the beliefs underlying public attitudes towards these systems; and analytical approaches to integration of the resulting technical and social data in decision-making.

Results to date

C. 56. The risk assessment research group was formed in 1974, Agency staff being augmented by IIASA professional staff and by scientists seconded cost-free to the Agency by interested Member States (nine Member States have participated through the secondment of scientists).

C. 57. Research results are being reported by invitation at scientific conferences and symposia and being published in appropriate professional journals, in the IIASA report series and in the Agency's Bulletin; so far more than 50 scientific papers and reports have been published.

C. 58. Methods developed by the group for assessing public attitudes to nuclear power have been employed in surveys carried out in three Member States; the findings could be used in Member States for rendering the "nuclear debate" less irrational.

Plans for 1979-80

C. 59. Activities will include: comparison of the risks associated with different energy systems; identification and assessment of existing non-nuclear risks; studies of the cost-effectiveness of risk reduction systems; the development and application of techniques for investigating quantitatively public attitudes towards energy systems; the determination of the relative importance of technical and economic factors as opposed to social and psychological factors in the formation of such attitudes; and the adaptation of formal analytical methods for use in helping to integrate the resulting technical and social data in public decision-making.

C. 60. The Agency will provide training for persons from Member States and help Member States to perform risk assessment studies, to use methods for the quantitative investigation of public attitudes and to analyse and interpret the resulting data. A co-ordinated research programme which will include the analysis of local differences in risk assessment and cross-cultural comparisons of public attitudes toward energy systems is planned.

C. 61. The work of the risk assessment research group has so far been oriented towards the development of suitable methodologies; during the period 1979-80 it will begin to focus on applications to practical problems in the nuclear energy field, with methodological improvements made as experience is gained. It is expected that interested Member States will continue to second scientists cost-free to the Agency in support of the group's work.

Plans for 1981-84

C. 62. The emphasis will continue to shift in the direction of practical applications.

Radiological protection services for the Agency's own operations and for Agency-assisted operations

Objective

C. 63. The objective is to provide adequate radiological protection services for the Agency's laboratories and for all persons for whose radiological protection the Agency is responsible and to control the radiological impact of the Agency's own operations on the general public and the environment.

Results to date

C. 64. This component was initiated in 1963. Radiological protection rules and procedures, based on the Agency's safety standards, for all work by Agency staff members and technical assistance experts which might involve exposure to radiation were originally formulated and kept up to date as part of the activities comprising this component; the formulation and updating of the rules and procedures is now the task of the interdepartmental Radiation Protection Committee, for which advice continues to be provided. A radiation protection group consisting of the radiation health and safety officer and the health physicists and technicians required under the Agency's Radiation Protection Rules and Procedures has been established; its members are drawn from the staff of the Radiological Safety Section.

C. 65. During the period 1972-77, personnel monitoring services for external irradiation and bioassay and whole-body monitoring services for internal irradiation were arranged for staff of the laboratories at Seibersdorf, Monaco and Headquarters, for safeguards inspectors and for other staff. Radiation surveillance was provided on a continuous basis at Seibersdorf. Advice was given on radiological protection aspects of the design and construction of the Safeguards Analytical Laboratory (SAL), which has been operating since 1976 under a "Type B" licence issued by the Austrian authorities. Arrangements were made to provide suitable medical care for staff members who might be involved in radiation accidents.

C. 66. A small stock of special instruments is maintained in good working order for use in emergency situations.

C. 67. The safety analysis reports for SAL and for the new dosimetry and medicine wing of the Seibersdorf Laboratory have been reviewed and assistance and advice has been provided with respect to commissioning.

Plans for 1979-80

C. 68. The Radiological Safety Section will continue to provide the personnel of the Radiation Protection Group. Personnel monitoring services, training and instruction will be provided as required for staff of the laboratories at Seibersdorf, Monaco and Headquarters, for safeguards inspectors and other staff and for technical assistance experts who may be exposed to radiation in the course of their work. Radiation- and contamination-monitoring services will be provided at Seibersdorf and records will be maintained of all personnel-monitoring and other physical-surveillance results. The stock of monitoring and testing instruments, protective equipment and supplies will be kept up to date and extended as required. In 1979, the stock of monitoring instruments will be increased significantly to meet the radiation surveillance requirements of SAL and of the new dosimetry and medicine wing. All instruments, protective clothing, equipment and supplies will be checked periodically.

Related activities

C. 69. The Agency's laboratories at Seibersdorf and at Headquarters will continue to provide bioassay and whole-body monitoring services for occupationally exposed staff. At present about 250 bioassay and 250 whole-body monitoring assessments are performed per year. The laboratory at Seibersdorf will also provide technical services for any environmental monitoring required.

Plans for 1981-84

C. 70. The work under this component will be modified and extended as necessary to meet the needs of the expanding safeguards inspectorate and the laboratory programmes. It is expected that the work load will continue to increase and a need for additional staff and equipment is foreseen.

Emergency assistance with regard to radiation accidents

Objective

C. 71. The objective is to help Member States in improving their radiation accident handling capabilities and to enable the Agency to assist in co-ordinating the provision of additional emergency assistance which Member States may require.

Results to date

C. 72. This component was initiated in 1961. A system has been established for helping Member States to obtain any additional assistance they might require for dealing with the consequences of radiation accidents. A document (Document WP/35) prepared in collaboration with ILO, WHO and FAO and distributed to all Member States outlines the nature of the emergency assistance which Member States might be willing to make available on request and indicates the preferred channels of communication; this document is brought up to date periodically. The Agency is prepared to act, on request, as an intermediary and, if necessary, to send staff members to the site of an accident.

C. 73. A number of regional training courses, organized by the Agency, on plans and procedures for handling radiation emergencies and accidents have included field exercises based on a variety of simulated accident situations.

C. 74. The Nordic Agreement on Emergency Assistance, prepared in co-operation with the Legal Division, was signed by Denmark, Finland, Norway, Sweden and the Agency

in 1963; model agreements for the provision of emergency assistance by Member States on a bilateral or multilateral basis have also been prepared in co-operation with the Legal Division.

C. 75. During the period 1972-77, tests were carried out from time to time of the smooth working of the system for alerting Agency staff and sending them to the site of an accident in response to a request received at any time; also a consultant reviewed the system and drew up recommendations for its improvement.

C. 76. Replacement and additional items of equipment were added, as required, to the stock of instruments and equipment held in readiness for use by staff members in an emergency and new staff members were given instructions concerning their possible role in co-ordinating emergency assistance.

C. 77. Criteria and data relating to the evaluation of radiation emergencies and accidents were published in the Agency's Technical Reports Series in 1974.

C. 78. Member States were encouraged to conclude agreements for the provision of mutual emergency assistance. In 1977, the Agency and the Office of the United Nations Disaster Relief Co-ordinator (UNDRO) concluded an agreement concerning the co-ordination of emergency activities in the event of radiation accidents.

Plans for 1979-80

C. 79. The handling of radiation accidents soon after they occur will be covered in regional seminars and training courses, and advice will be given to Member States wishing to improve their radiation accident handling capabilities.

C. 80. The emergency assistance system will be maintained and tests of the smooth working of the Agency's response to simulated requests will be carried out periodically as in the past. The manual for Agency staff on the provision of emergency assistance will be brought up to date and extended as required. The document outlining the nature of the emergency assistance which Member States might be willing to make available on request will be brought up to date, if possible in collaboration with ILO, WHO and FAO. Newly appointed staff members will be given instruction concerning their possible role in the emergency assistance system.

C. 81. Replacement and additional items will be added, as required, to the stock of instruments and equipment held ready for use in an emergency and all items will be checked at regular intervals.

C. 82. Member States will continue to be encouraged to enter into bilateral, multi-lateral, regional or other agreements for the provision of mutual emergency assistance. The Agency's emergency assistance system will be reviewed by an outside expert in 1979.

Related activities

C. 83. Radiochemical analyses of environmental samples and bioassay measurements can be performed in the Agency's Laboratory as a contribution to the emergency assistance offered to Member States. The staff of other Divisions who have appropriate specialized knowledge or experience are listed with a view to their helping to respond to requests for advice or assistance.

Plans for 1981-84

C. 84. The emergency assistance system will be developed and extended as appropriate and tests of the Agency's response to simulated requests for assistance will be carried out from time to time. The instruments and equipment held in stock will be reviewed and replaced as required.

Co-operation with other organizations

C.85. This component involves co-operation with ILO, WHO, FAO and UNDRO in the collection and distribution of information and in the provision of assistance when required.

Waste management

OBJECTIVE

C.86. The objective is to review the management of wastes arising in the peaceful uses of nuclear energy, with particular emphasis on the nuclear fuel cycle and the problem of safe, long-term storage and disposal of such wastes; to develop and review techniques for maintaining releases of radionuclides and other contaminants from the nuclear industry at acceptable levels, assess the consequences of actual releases and evaluate the potential impact on the environment; and to develop and disseminate information and advise Member States on the methods of safe management of radioactive wastes.

PLANS FOR 1979-84

C.87. The Agency will continue to provide a forum for the exchange of information on the management and disposal of radioactive wastes and for discussing the needs of Member States in those areas and to encourage research which will be useful for waste management and environmental assessment purposes. Information on technology and the state of the art will be disseminated through symposia, technical meetings and reports, guide-books and advisory missions. Emphasis will be placed on the formulation of guidance for waste treatment and handling and for underground disposal (with special reference to repositories for high-level and alpha-bearing wastes in deep continental rocks).

C.88. On the basis of the recommendations made by an advisory group which met in February of this year, a programme for the preparation of five codes and of associated guides concerning the underground disposal of radioactive wastes has been drawn up and initiated. It is planned that the following major subjects will be covered: regulatory activities; siting; waste acceptance criteria; design and construction of repositories; and operation and shut-down of repositories. It is foreseen that technical documents providing guidance on these subjects would be drafted during the years 1978-80/81 and that they would be examined in the light of experience during the period 1981-84 with a view to their being revised and issued as codes and guides.

C.89. Activities will include continuing studies, with a view to setting release limits, of the behaviour and fate in both terrestrial and marine ecosystems of radionuclides released to the environment from nuclear facilities. Attention will be paid to the management and disposition of gaseous radionuclides and to the decommissioning of redundant nuclear facilities.

STRUCTURE

C.90. This sub-programme consists of three components, which are described in the following paragraphs.

Waste management

Summary by programme components

Table C. 5

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Treatment and disposal of radioactive wastes	6.2	3.8	420 000	194 000	70 000	24 000	708 000
Nuclear energy and environmental impact	3.0	2.1	194 800	65 000	70 000	11 200	341 000
Decommissioning of nuclear facilities	0.7	0.4	45 500	25 000	-	500	71 000
Linguistic services	-	-	-	-	-	30 000	30 000
Printing and publishing services	-	-	-	-	-	105 000	105 000
TOTAL	9.9	6.3	660 300	284 000	140 000	170 700	1 255 000

Treatment and disposal of radioactive wastes

Objective

C. 91. The objective is to evaluate, disseminate and promote the exchange of information on technology for the management and isolation of radioactive wastes in such a way that releases of radionuclides to the environment are minimized and to develop codes and guides and safe procedures for the treatment, handling, storage and disposal of radioactive wastes (including suitable confinement of the radionuclides for the required periods of time) aimed at ensuring the long-term protection of the public and the environment and also the protection of waste management workers.

Results to date

C. 92. This component was initiated in 1958. Until recent years, it was concerned mainly with the philosophy and technology for the treatment of low- and intermediate-level radioactive wastes, information in these areas being exchanged by and made available to Member States. During the past few years however, increasing emphasis has been placed on the treatment and possible options for the disposal of the highly radioactive (high-level) liquid residues from the reprocessing of spent nuclear fuels.

C. 93. One of the principal issues underlying the difficulties of expanding nuclear power programmes is the growing concern about the management of the radioactive wastes arising from the various operations involved in the nuclear fuel cycle (ranging from mining and milling waste to the high-level liquid residues from spent fuel reprocessing) and about the management of the spent nuclear fuels themselves. Although suitable technology and processes for managing the present amounts of radioactive waste and effluents from nuclear facilities have been conceived and have been or are being developed, more needs to be done in preparation for the future by way of demonstrating the technology and harmonizing the principles on which waste management policies and practices should be based. In 1972, at a symposium organized by the Agency and NEA, the management of radioactive wastes arising from nuclear fuel reprocessing operations was reviewed; in 1976, also at a symposium organized by the Agency and NEA, the current situation regarding the management of radioactive wastes generated by the major types of nuclear fuel cycle facility was reviewed (the proceedings of both symposia have been published). Radioactive waste management and effluent control were the subject of a plenary session and three technical sessions at the Salzburg Conference, which also included a round-table discussion on options for the disposal of solid high-level and long-lived (alpha-contaminated) radioactive wastes.

C. 94. Information on the management of high-level and alpha-bearing wastes was exchanged at meetings of a technical committee in 1974, 1975, 1976 and 1977; the 1977 meeting took place in conjunction with an NEA-sponsored seminar on the management of alpha-bearing waste, where progress and national programmes in this area were reviewed.

C. 95. Panels were convened in 1972 and 1974 to prepare guidelines on the choice of burial conditions for low- and intermediate-level radioactive waste concentrates which have been incorporated into bitumen or concrete. The guidelines formed a basis for an advisory group meeting in 1976 which initiated the drafting of guides for the selection, preparation, operation and release of shallow land burial sites for radioactive waste.

C. 96. Among the technical documents published during the period 1972-77 were a volume in the Agency's Safety Series entitled "Management of Wastes from the Mining and Milling of Uranium and Thorium Ores - a Code of Practice and Guide to the Code" (Safety Series No. 44) and three volumes in the Technical Reports Series. The publication of waste management research abstracts continued and technical documents on the safe handling of radioactive wastes at nuclear power plants, the safe storage, handling and movement of fuel and related components at nuclear power plants, characteristics of solidified high-level waste products and the safe handling and storage of high-level liquid radioactive wastes requiring cooling were prepared for publication this year.

C. 97. Work relating to the separation of the actinides from high-level waste, to solidified high-level waste products and to particulate filters has been carried out under co-ordinated research programmes (Table C. 7, Nos 4, 5 and 10).

Plans for 1979-80

C. 98. A major activity will continue to be the formulation of guidelines (which will ultimately lead to the preparation of codes) for the underground disposal of radioactive wastes, including disposal in suitable geological formations and shallow land burial. It will involve the publication of licensing and approval procedures for repositories of radioactive waste and the preparation of guidance on safety assessments for geological disposal (Advisory Group - Annex II (42); Advisory Group in 1980), on site investigations for repositories of solid waste (Advisory Group - Annex II (43)) and on the disposal of liquid waste in deep continental rocks by both hydrofracturing and direct injection (Advisory Group - Annex II (44); Advisory Group in 1980). Guidance on the selection, preparation, operation and release of shallow land burial sites for suitably prepared low- and medium-level wastes is expected to be available during 1980; it will include a methodology for the study and evaluation of radionuclide migration in potential land burial sites. The preparation of guidance for investigating very slow groundwater migration rates will be initiated in 1980 in co-operation with the Agency's Isotope Hydrology Section (Technical Committee). Recent developments concerning the underground disposal of radioactive waste will be reviewed - at a meeting which may be organized in collaboration with NEA - in 1979 (Symposium - Annex I (8)); the Agency's draft codes and guides for geological disposal will be examined in 1980 (Technical Committee).

C. 99. In 1980, an additional Professional post (at the P-4 level) will be required, primarily for the radioactive waste disposal area.

C. 100. The preparation of codes of practice and guides for the management of high-level liquid waste will be initiated with one on its storage (Technical Committee - Annex II (37); Advisory Group in 1980), to be followed by one on its solidification (Technical Committee). There will be a review in 1979 of the state of the technology and requirements for the preparation of spent fuel elements for long-term storage and/or disposal (Technical Committee - Annex II (38)); the disposal of suitably prepared spent fuel elements is considered similar to the disposal of solidified high-level waste, and the two activities are being handled together under this programme component. During the period 1979-80, technology for and developments in the management and disposal of alpha-bearing waste will be handled together with activities relating to low- and medium-level waste or high-level waste as appropriate. There will be a review of the state of the art and the philosophy in 1979 (Technical Committee - Annex II (33)).

C.101. The preparation of a code of practice and a guide for waste management at uranium-refining facilities (Advisory Group - Annex II (41)) will be completed. The preparation of a code of practice and a guide for waste management at uranium enrichment facilities will be completed in 1980 (Advisory Group).

C.102. In 1979, there will be a review and exchange of information on developments in the treatment of low- and medium-level liquid waste (Technical Committee - Annex II (34)) which have occurred since the 1970 symposium on the management of low- and intermediate-level radioactive wastes and of information on volume reduction techniques for solid radioactive waste (Technical Committee - Annex II (36)). Furthermore, it is planned to initiate the revision and updating of the Agency publications "Treatment of low- and intermediate-level radioactive waste concentrates" (Technical Reports Series No. 82; 1968) and "Bituminization of radioactive waste concentrates" (Technical Reports Series No. 116; 1970) (Technical Committee - Annex II (35); two Advisory Groups in 1980).

C.103. Developments in the technology for controlling the release of gaseous radionuclides and radioactive particulates from nuclear facilities will be reviewed in 1980 (Technical Committee; Symposium - Annex III (4)). A technical document on the retention of gaseous radionuclides from nuclear power plants will be prepared (Technical Committee - Annex II (32); Advisory Group in 1980).

Plans for 1981-84

C.104. Guidance and other assistance will be provided in connection with waste management programmes and facilities appropriate to the individual needs of Member States, account being taken of the special requirements of countries with developing nuclear power programmes. Work will continue on codes and guidance for the management and underground disposal of radioactive wastes (especially high-level and alpha-bearing wastes), with emphasis on the design, construction and operation of repositories. In addition, the factors involved in hazard analyses relating to the management and disposal of such wastes and to repository operation will be analysed; the long-term management of spent nuclear fuels will be considered in this context.

C.105. The preparation of codes and guides for the management of both radioactive and non-radioactive wastes from selected nuclear facilities will continue. Emphasis will be placed on reviewing and updating the publications concerning waste management technology which were issued before 1975 in the Agency's Safety Series and Technical Reports Series.

C.106. The handling, storage and disposal of contaminated fuel hulls from the reprocessing of irradiated fuel will be given increasing attention with a view to recommending suitable courses of action. Work on improving the technology for the management of low- and medium-level waste (especially that connected with the operation of nuclear power plants and irradiated fuel storage basins) will be encouraged and followed. Attention will be paid to the processing of plutonium-containing waste (scrap) for the purpose of recovering the plutonium.

C.107. The waste management implications of both present and future fission reactor types (especially the potential impact of fast breeders on waste management activities and on the overall fuel cycle) will be studied; in this connection, consideration will be given to the waste management implications of fusion reactors if a demonstration facility is expected to go into operation in the foreseeable future.

C.108. Attention will be paid to the management and control of tritium-contaminated effluents and to the gaseous and semi-volatile radionuclides emanating from nuclear facilities. The initiation of work on codes and guides for the measurement and control of gaseous and particulate radioactivity in gaseous effluents is planned. The origin, forms and control of carbon-14 will be investigated. With regard to radioactive gaseous and liquid discharges from nuclear facilities, continuing efforts will be made to secure international co-operation in the harmonization of principles and in the review of national policies for their release.

One matter of particular concern will be the question of effluent management systems involving the release of radionuclides which spread beyond national boundaries. Attention will also be paid to the technical and operational aspects of and procedures for the preparation of radioactive waste and other radioactive materials for dumping at sea and to the dumping operation itself.

Co-operation with other organizations

C.109. This component involves co-operation with WHO, WMO, UNEP, ECE and IMCO; it also involves collaboration with NEA, CMEA and CEC in the sponsoring of meetings and the publication of reports.

Nuclear energy and environmental impact

Objective

C.110. The objective is to assess the potential impact on the individual, on the public and on sensitive organisms in ecological networks of the radiological and chemical effects arising from the radioactive and thermal releases from nuclear fuel cycle facilities to the environment and the storage and/or disposal of radioactive wastes; to promote and co-ordinate the compilation of fundamental data for evaluating the environmental significance and behaviour of both radioactive and non-radioactive pollutants and for studying their transfer through food and other ecological chains; and to develop and disseminate a methodology and computational techniques for establishing authorized limits for the release of radionuclides from nuclear facilities in accordance with the dose limitation principles and recommendations of ICRP.

Results to date

C.111. This component was initiated in 1972, since when seven symposia and a seminar have been held and several technical documents published - including one in the Safety Series entitled "Disposal of Radioactive Wastes into Rivers, Lakes and Estuaries" (Safety Series No. 36; 1972).

C.112. In connection with the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the London Dumping Convention), which gave the Agency the responsibility of defining criteria and making recommendations regarding the dumping of radioactive wastes and other radioactive matter at sea, an advisory group on oceanographic modelling which met in 1975 came to the conclusion that knowledge regarding the phenomena occurring in the deep sea was inadequate.

C.113. At their first consultative meeting, in September 1976, the contracting parties to the London Dumping Convention accepted the "Provisional Definition and Recommendations" which had resulted from a number of Agency-organized meetings but requested the Agency to do further work on them. Accordingly, during 1976 and 1977 the Agency convened several meetings for the purpose of reviewing the oceanographic and the radiological basis of the "Provisional Definition and Recommendations" before the third consultative meeting of the contracting parties in October of this year.

C.114. Considerable effort has gone into encouraging the collection of fundamental data and the development of a methodology for use in assessing the local, regional and global effects of radioactive and thermal releases into rivers, seas and the atmosphere and of the cycling of radionuclides through various ecosystems; there has been increasing emphasis on co-ordinated research programmes for this purpose (Table C. 7, Nos 2 and 3).

C.115. Advisory group meetings have been held to develop procedures for assessing the effects of and establishing limits for radioactive, non-radioactive and thermal discharges from nuclear facilities and preparing guidance on a methodology for the experimental evaluation of the effects of releases of radionuclides into aquatic environments.

Plans for 1979-80

C. 116. It is expected that the Agency will have discharged its responsibility - assumed in connection with the Convention for the Protection of the Mediterranean Sea against Pollution - for defining radioactive matter unsuitable for disposal into the Mediterranean and recommending the conditions under which radioactive matter falling outside the definitions could enter the Mediterranean by the end of 1980 (Advisory Group - Annex II (45); Advisory Group in 1980).

C. 117. Guidelines for the specifications of containers for the ocean dumping of radioactive substances will be formulated in 1979 in collaboration with NEA (Advisory Group - Annex II (46)). The "Provisional Definition and Recommendations" relating to the London Dumping Convention will be reviewed in 1980 (Advisory Group), account being taken of any improved oceanographic models and of the latest information regarding radionuclides in the marine environment. As the information on conditions at the radioactive waste disposal sites in the deep ocean is very scant, studies of the effects of the physical-chemical changes and the dispersion phenomena which affect the biological transfer of radionuclides to man will be encouraged. In this connection, it is planned to initiate in 1979 co-ordinated research on the behaviour of the transuranium elements and selected fission products in marine sediments (Technical Committee - Annex II (40)) and to update in 1980 (Technical Committee) the Agency publication "Disposal of Radioactive Wastes into Marine and Fresh Waters" (Safety Series No. 5; 1962). Also in 1980 there will be a comprehensive review of questions relating to the release of radioactivity into the seas and oceans and to the behaviour of radionuclides in marine environments (Symposium - Annex III (5)).

C. 118. The Agency's environmental assessment programme will be reviewed in 1979 (Advisory Group - Annex II (48)). The distribution and behaviour of certain radionuclides, such as carbon-14, in the environment will continue to be investigated. Work will continue on assessing (in co-operation with UNEP, WHO, UNSCEAR and NEA) the environmental impact and thermal and radiological effects of nuclear power and on the collection of fundamental data concerning these subjects. Environmental assessments will cover, in particular, the local, regional and global impact of liquid and gaseous radioactive releases from nuclear facilities and - in 1980 - the physical processes involved in the atmospheric dispersion of airborne nuclides (Technical Committee).

Plans for 1981-84

C. 119. Criteria and guidance relating to the environmental aspects of the discharge and dumping of radioactive materials into the seas and oceans will be formulated. Ecological studies of marine environments will be undertaken with a view to the preparation of guides for the environmental assessment of radioactive waste dumping at sea, as compared with land burial, to the definition of "de minimis" quantities and to the selection and management of dumping sites. The "Provisional Definition and Recommendations" relating to the London Dumping Convention and those relating to other, similar international conventions will be reviewed periodically. It is expected that the Agency will be given responsibility for defining permissible discharges of radioactive contaminants under further conventions (both international and regional).

C. 120. Assessments of the environmental impact of nuclear fuel cycle operations and the collection of data for such assessments will continue, together with work on procedures and guidelines for performing environmental impact analyses for selected radionuclides; computer-based models will be used to an increasing extent in these activities. Special efforts will be made, in the light of ICRP's new radiation protection principles, to develop a methodology for optimizing the containment of radionuclides and thereby minimizing their release to the environment. The application of cost-risk-benefit analysis in the environmental protection and waste management areas will be reviewed.

C. 121. The environmental impact of advanced reactor concepts and of any associated changes in the nuclear fuel cycle will be analysed. Emphasis will be placed on the environmental impact of fast breeders and high-temperature reactors, especially in the light of the

activation of trace elements in coolant systems. The environmental impact of fusion reactors will also be considered if there is sufficient interest among Member States.

C.122. The long-range environmental effects of different radioactive waste disposal systems and the immediate effects of waste management operations such as solidification will be studied. If it is considered necessary, attention will be paid to the mining and milling of uranium and thorium ores, as the impact of uncontrolled releases of radionuclides during such operations could be greater than that of controlled releases from reactors and fuel reprocessing plants.

C.123. Consideration will once again be given to the registering of radioactive waste (radionuclide) releases and disposals by the nuclear industry.

Co-operation with other organizations

C.124. Consultations and co-operation are maintained with UNEP and also with WHO, FAO, UNESCO, WMO, ECE, NEA, CEC and ICRP.

Decommissioning of nuclear facilities

Objective

C.125. The objective is to collect and disseminate information on all aspects of nuclear facility decommissioning, including decontamination procedures; to facilitate international co-operation in the development of decommissioning technology and procedures and in the collation and exchange of decommissioning experience; and to develop codes and guides for the use of designers and regulatory authorities in considering the short- and longer-term implications of decontaminating and decommissioning nuclear fuel cycle facilities and the disposition of the resulting radioactive materials.

Results to date

C.126. This component was initiated in 1973 following a consultants' meeting. In 1975, a technical committee met to exchange information based on decommissioning and decontamination experience; an unpriced technical document (IAEA-179) resulted. In a number of countries, focal points for the exchange of information on technical problems and experience have been designated. A second technical committee, convened in 1977, has drafted a technical document complementary to document IAEA-179 and a working paper to be used as a basis for the preparation of a code and guide for decommissioning land-based nuclear reactors.

C.127. Approval has been given for a co-ordinated research programme on contaminated organic liquids and gases (Table C.7, No. 1).

Plans for 1979-80

C.128. It is expected that the code and guide for decommissioning land-based nuclear reactors will be finalized in 1979 (Advisory Group - Annex II (47)). The preparation of a manual on decontamination procedures for nuclear power stations in service and on decontamination waste handling will be initiated in 1979 (Technical Committee - Annex II (39)), with emphasis on reducing the quantities of decontamination waste. A meeting will be convened in 1980 (Technical Committee) to review progress in decommissioning technology and procedures since the 1978 symposium on decommissioning sponsored by the Agency and NEA; experience of decontaminating facilities while they are still in operation will be reviewed for the purpose of improving decommissioning procedures. A start is expected to be made on specifying radiological criteria for and methods of handling decommissioning waste.

C.129. Questions concerning the design of nuclear facilities with a view to easier decommissioning may be considered by consultants in the light of discussions at the 1978 symposium on decommissioning.

Plans for 1981-84

C. 130. Technical committee and advisory group meetings will be held for the exchange of information and the discussion of common problems and for the preparation of decommissioning codes and guides (where sufficient information exists for their preparation). Considerable emphasis will be placed on determining permissible radioactivity levels for decommissioned nuclear sites and the maximum radionuclide content which decontamination waste may have if it is to be handled without restrictions. Information (including cost and other data) based on decommissioning experience will be assembled, analysed and disseminated.

Co-operation with other organizations

C. 131. This component involves co-operation with NEA, UNEP, ECE and CEC.

Nuclear safety

OBJECTIVE

C. 132. The objective is to give Member States up-to-date advice and assistance (through advisory missions, the gradual establishment of a coherent and comprehensive set of internationally acceptable safety codes and guides, the exchange of information and intensive training relating to specific nuclear safety and regulatory topics) in connection with the licensing, siting, design, construction and operation of research reactors, nuclear power plants and other nuclear facilities and - on a limited scale at present - advice on the safety of ports receiving nuclear merchant ships.

PLANS FOR 1979-84

C. 133. During this period, the Agency will, through its safety standards programme, publish a number of safety guides to complement the codes of practice already issued by 1979; in addition, earlier safety guides will be updated and - where appropriate - their scope will be extended to include advanced nuclear power plants and fuel cycle facilities, the final aim being an internationally agreed set of safety codes and guides, the need for which has become clear as more and more developing countries have purchased nuclear power plants.

C. 134. In the light of over 17 years' experience, it is expected that there will be a considerable increase in the number of requests for advisory services and safety assessments relating to siting, design, construction and operating questions.

C. 135. The exchange of information through symposia and seminars will continue in certain fields. Efforts to help (in particular, through the provision of training and of guidance on regulatory activities and other relevant topics) Member States embarking on nuclear programmes to cope with reactor safety matters by themselves will be intensified.

C. 136. An exchange of information on the progress in nuclear safety research and development in Member States will be promoted and nuclear safety research and development activities will be co-ordinated.

STRUCTURE

C. 137. This sub-programme consists of five components, which are described in the following paragraphs.

Nuclear safety

Summary by programme components

Table C. 6

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Nuclear safety standards for thermal-neutron nuclear power plants	5.7	3.5	469 900	269 000	-	8 100	747 000
Nuclear safety standards for advanced nuclear power plants and for fuel cycle facilities	-	-	-	-	-	-	-
Advisory missions and safety evaluations of nuclear reactors and other nuclear facilities	4.3	2.1	269 000	-	-	35 000	304 000
Exchange of information and training	1.0	0.3	58 900	-	-	1 100	60 000
Nuclear safety research and development	0.4	0.4	30 000	20 000	7 000	1 000	58 000
Linguistic services	-	-	-	-	-	185 000	185 000
Printing and publishing services	-	-	-	-	-	185 000	185 000
TOTAL	11.4	6.3	827 800	289 000	7 000	415 200	1 539 000

Nuclear safety standards for thermal-neutron nuclear power plants

Objective

C. 138. The objective is:

- (a) to prepare an internationally agreed set of recommendations (in the form of codes, guides and manuals) on the safety of thermal-neutron nuclear power plants (1982);
- (b) to review - possibly employing a simplified procedure - such codes, guides and manuals so as to take into account the advance of the technology and the experience gained in using them; and
- (c) to promote the use in national regulations and international standards of the Agency's safety codes and guides.

Results to date

C. 139. Since the NUSS programme was initiated in September 1974, five codes of practice relating to thermal-neutron nuclear power plants (on governmental organization, siting, design, operation and quality assurance) have been prepared. Some ten safety guides have been prepared and many more are in various stages of preparation or review.

Plans for 1979-80

C. 140. During this period, Senior Advisory Group and Technical Review Committee meetings will be held in accordance with a schedule already established (see Annex II (49-70) for the meetings planned for 1979). For each of the above-mentioned codes of practice four

or five safety guides will be completed and preliminary work will be done on preparing manuals for application of the codes and guides. In addition, a start will be made with the development of a simplified procedure for reviewing the codes, guides and manuals after they have been published.

Plans for 1981-84

C. 141. It is expected that, with the publication of some ten safety guides in each of the years 1981 and 1982, the set of codes and guides originally envisaged will be complete by the end of the latter year. The codes and guides already issued will be revised or supplemented in the light of experience gained with them in practice and of further experience in operating the present generation of nuclear power plants. The use of the codes and guides in establishing national regulations and international standards will be promoted through the preparation of manuals for their application, through Agency participation in national and international meetings and through the preparation of check-lists based on the codes and guides, designed for use during Agency safety missions and covering all points which experts should take into account if they are to make objective judgements.

Co-operation with other organizations

C. 142. This component involves co-operation with NEA, CMEA, ISO, CEC, WMO, WHO and the International Electrotechnical Commission.

Nuclear safety standards for advanced nuclear power plants and for fuel cycle facilities

Objective

C. 143. The objective is to prepare safety codes and guides for advanced reactor types and for nuclear fuel cycle facilities.

Plans for 1979-84

C. 144. Steps will be taken to extend the safety standards programme to the preparation of codes and guides for nuclear fuel cycle facilities. As it is expected that national safety standards for advanced nuclear power plants will have been issued by 1980, work will start on Agency safety standards for such plants. This activity will grow as staff working on the NUSS programme becomes available, reaching full scale after 1982.

Co-operation with other organizations

C. 145. This component will involve co-operation with NEA, CMEA, ISO, CEC, WMO, WHO and the International Electrotechnical Commission.

Advisory missions and safety evaluations of nuclear reactors and other nuclear facilities

Objective

C. 146. The objective is to advise and assist Member States in connection with the safety aspects of nuclear power plants (including the power plants of nuclear merchant ships) and other nuclear facilities by organizing and co-ordinating the safety missions of Agency staff members and external experts after the study of safety-related reports at Headquarters.

Results to date

C. 147. Safety assessments of research reactor sites have been made since 1960 and advice has been provided on safety levels at nuclear research centres. Advice has been given on the siting of nuclear power plants and safety assessments have been made for such plants at the pre-construction, construction and operating phases. All Agency reactor projects have been evaluated from the nuclear safety point of view before being submitted to

the Board of Governors for approval in accordance with statutory requirements; most of the reactors in question have been examined at a later stage and advice on maintaining high safety standards has been given to the responsible national authorities. On average, 12 advisory missions a year have taken place since 1973.

C. 148. Advice has been given on the safety aspects of the entry into ports of a nuclear merchant ship.

Plans for 1979-80

C. 149. It is expected that the number of requests from Member States for advice on the licensing of nuclear power plants, on the safety aspects of site selection, on the safety assessment of plants and on the safety aspects of the technical specifications set forth in bids will continue to increase (to ten or more a year). The number of safety assessments required under Agency reactor project agreements is also expected to increase. Although remaining relatively modest in number, port evaluations for the entry of nuclear merchant ships will probably continue to be requested. Periodic safety missions (every two-three years) will continue to be arranged in connection with research reactors covered by project agreements and an offer will be made to expand the scope of such missions to include nuclear facilities not covered by project agreements and to carry out nuclear safety inspections at nuclear facilities in groups of Member States on a regional basis. In view of the increase in work load, an additional Professional post (at the P-4 level) will be needed - see Table C. 2 and Annex V.

Plans for 1981-84

C. 150. It is expected that during this period the number of requests for safety advice will increase considerably in respect of all stages of licensing - from siting to operation. It may be necessary to initiate safety assessments of advanced nuclear power plants. Nuclear safety inspections will continue to be carried out in Member States which are parties to reactor project agreements with the Agency, and the offer to expand the scope of safety missions to include nuclear facilities not covered by project agreements will be maintained. Safety assessments relating to nuclear merchant ships may have to be extended to include the passage of such vessels through narrow waterways.

Co-operation with other organizations

C. 151. This component involves co-operation with WMO and WHO.

Exchange of information and training

Objective

C. 152. The objective is to assist Member States in the introduction of nuclear power through regional and interregional training courses on nuclear facility licensing and regulation and through seminars and symposia relating to the safety of nuclear power plants and to the implementation of the safety codes and guides.

Results to date

C. 153. Staff members have lectured on regulatory activities (including nuclear power plant site and safety evaluations) at the nuclear power project training courses at the Kernforschungszentrum Karlsruhe, at Argonne National Laboratory, and at the Centre d'études nucléaires de Saclay. Lectures on safety matters have also been given by staff members participating in technical assistance missions to several developing Member States which are considering the introduction of nuclear power or are about to embark on nuclear power projects. Arrangements have been made for a staff member to act as scientific officer during an eight-week course (to be held this year at Argonne National Laboratory) in which safety analysis reports on currently operating nuclear power plants will be used as a basis for training participants to conduct plant safety reviews.

Plans for 1979-80

C. 154. Current aspects of nuclear power plant siting (including siting near urban centres and at off-shore locations) will be examined in 1980 (Symposium - Annex III (6)). Also in 1980, the safety problems arising from the interaction of an electric grid of limited installed capacity with a nuclear power plant will be reviewed (Seminar). Safety topics will continue to be included in nuclear power project training courses organized by the Agency.

Plans for 1981-84

C. 155. The exchange of technical information through seminars and other types of meeting will continue in specific safety and regulatory areas. One or two meetings will be held each year on subjects such as siting, safety analyses, engineering safety features and reference safety analysis reports.

Nuclear reactor safety research and development

Objective

C. 156. The objective is to keep abreast of the progress in nuclear safety research and development in Member States and to co-ordinate (in co-operation with other international organizations) nuclear safety research and development activities in Member States through liaison with national regulatory bodies in respect of ongoing and planned safety research and of safety research facilities.

Results to date

C. 157. An advisory group on thermal reactor safety research and development met in 1977 and formulated recommendations concerning the Agency's activities in this field; a further advisory group meeting has been planned for this year. Liaison with NEA on topics of common interest in the field of nuclear safety has been maintained through the Committee for Safety of Nuclear Installations.

Plans for 1979-80

C. 158. There will be discussions with CEC, CMEA and NEA on the possibility of the Agency's arranging with them an exchange of information in the field of reactor safety research and development and on co-operation in organizing meetings and preparing a plant reliability data base. In conjunction with these international organizations, recommendations on how the Agency might expand or continue its activities relating to specialized topics in the field of thermal-neutron reactor safety research and development and encourage collaboration among national groups already active in this field will be formulated in 1979 (Advisory Group - Annex II (71)); similar recommendations concerning fast reactors will be formulated in 1980 (Advisory Group). One aim is for the Agency to bring together, at NEA meetings, reactor safety research and development workers from both NEA and non-NEA countries.

C. 159. The Agency's participation in international reactor safety research programmes will continue.

Plans for 1981-84

C. 160. Symposia or seminars for disseminating to developing countries the results of reactor safety research and development work will be proposed. As additional safety research facilities become operational and as the results of ongoing national safety research programmes emerge, topics for meetings on thermal-neutron and fast reactor safety research will be considered (such topics might include core melt-down and after-heat removal, the safety of automatic control systems and the development of risk analysis techniques).

Co-operation with other organizations

C. 161. This component involves co-operation with NEA, CMEA and CEC.

Co-ordinated research programmes

Table C. 7

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
1. Studies of the decontamination, treatment, storage and disposal of contaminated organic liquids and gases arising from the exploitation of nuclear energy	This programme has been approved but no contract has yet been awarded.			
2. Studies on the source, distribution, movement and deposition of radium in inland waterways and aquifers	4	4	1975	1980
3. Physical and biological effects on the environment of cooling systems and thermal discharges from nuclear power stations	1	6	1973	1978
4. Environmental evaluation and hazard assessment of the separation of the actinides from the high-level waste from fuel reprocessing followed by either transmutation or separate disposal	-	7	1976	1979
5. Evaluation of solidified high-level waste products	-	12	1977	1982
6. Cell membrane probes as biological indicators in radiation accidents	1	4	1977	1982
7. Environmental monitoring for radiological protection in South East Asia, the Far East and the Pacific region	10	1	1973	1979
8. Radiological and environmental protection studies in the Danube river catchment area	5	-	1976	1981

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
9. Environmental monitoring for radioactive contaminants in the vicinity of nuclear installations in Latin America	-	1	1975	1980
10. Methods for testing particulate filters	-	3	1977	1980

D. NUCLEAR EXPLOSIONS FOR PEACEFUL PURPOSES

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table D. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	63 951	86 000	5 000	(37 000)	(32 000)	54 000	56 000
Consultants	2 236	16 000	500	(7 700)	(7 200)	8 800	1 000
Overtime	104	500	-	500	500	1 000	-
Temporary assistance	604	4 500	200	(2 200)	(2 000)	2 500	-
Sub-total	66 895	107 000	5 700	(46 400)	(40 700)	66 300	57 000
Common staff costs	17 671	25 400	100	(10 000)	(9 900)	15 500	16 200
Travel	3 432	6 200	300	(2 500)	(2 200)	4 000	3 000
Meetings							
Technical committees, advisory groups	580	24 000	700	(6 700)	(6 000)	18 000	8 000
Representation and hospitality	41	1 300	100	(200)	(100)	1 200	800
Common services, supplies and equipment	72	1 100	-	(100)	(100)	1 000	1 000
Transfer of costs:							
Linguistic services	5 153	37 000	1 000	(24 000)	(23 000)	14 000	10 000
Printing and publishing services	9 725	20 000	1 000	(19 000)	(18 000)	2 000	30 000
Other services	73 000	84 000	5 000	-	5 000	89 000	95 000
TOTAL	176 569	306 000	13 900	(108 900)	(95 000)	211 000	221 000

SUMMARY OF MANPOWER

Table D. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
P-5	1	1	1	-	1	1
P-4	1	1	1	(1)	-	-
Sub-total	2	2	2	(1)	1	1
GS	1	1	1	-	1	1
TOTAL	3	3	3	(1)	2	2

CHANGES IN COSTS AND MANPOWER

Costs

D. 1. As will be seen from Table D. 1 above, the cost of this programme is expected to decrease by \$ 95 000 as the net result of price increases of \$ 13 900 and a programme reduction of \$ 108 900.

D. 2. The programme reduction of \$ 47 000 in respect of salaries for established posts and common staff costs is due to the abolishing of one Professional post. In the light of actual requirements during 1977, funds for consultants' services will be reduced by \$ 7700 and for temporary assistance by \$ 2200; this will be partly offset by an increase of \$ 500 for overtime. A reduction of \$ 2500 is foreseen in respect of duty travel. It is planned to hold one advisory group meeting in 1979, the same number as foreseen in the estimates for 1978. There will, however, be a programme decrease of \$ 6700. As regards the allocation of service costs, a reduction of \$ 24 000 is foreseen in respect of linguistic services and one of \$ 19 000 in respect of printing and publishing services.

Manpower

D. 3. As will be seen from Table D. 2 above, the manning table for 1979 has been reduced by one Professional post at the P-4 level.

THE PROGRAMME

OBJECTIVE

D. 4. The objective is to promote the exchange of information on peaceful uses of nuclear explosions, to develop procedures for their use, to study the economic, legal, health, safety and environmental aspects involved and to respond to requests for PNE-related services.

RESULTS TO DATE

D. 5. The activities constituting this programme were initiated in 1967 as a joint sub-programme within the "Nuclear power and reactors" and "Nuclear safety and environmental protection" programmes. In 1975, the Unit for Peaceful Nuclear Explosions Services was established and the sub-programme was made a separate programme.

D. 6. During the period 1972-77, three technical meetings were held on the phenomenology and practical aspects of nuclear explosions for peaceful purposes (PNEs); the status of the technology was reviewed at these meetings, the proceedings of which have been issued in the Agency's Panel Proceedings Series. A meeting was held on international observation of PNE projects by the Agency and the guidelines formulated at it have been approved by the Board of Governors.

D. 7. A working group was convened in 1974 to recommend procedures for the Agency to follow in responding to requests for PNE-related services; the procedures relate to the early stages of PNE projects and were followed in the course of a fact-finding mission concerning a potential PNE project in a Member State. The development of procedures to be followed by the Agency in the later stages of PNE projects was initiated in 1977.

D. 8. A register for taking note of Member States which wish to be registered as potential suppliers of PNE-related services has been opened.

D. 9. A catalogue of possible PNE applications and reports covering economic aspects, health and safety aspects and legal aspects was prepared as an aid to the Ad Hoc Advisory Group on Nuclear Explosions for Peaceful Purposes in the preparation of its comprehensive report, which was completed in 1977.

D. 10. Work on a trilingual (English, French and Russian) glossary of PNE terms has been completed. Work on updating the PNE bibliography has continued.

PLANS FOR 1979-80

D. 11. Future activities will depend on the prospects for using PNEs, particularly in developing countries.

D. 12. The report prepared by the Ad Hoc Advisory Group on the Peaceful Uses of Nuclear Explosions, which summarizes the status of PNEs and their economic, health and safety and legal aspects, will be the subject of review and periodic updating if new information becomes available. An advisory group meeting on health and safety aspects of the use of PNEs will be held in 1979 (Advisory Group - Annex.II (72)).

D. 13. It may be useful to arrange for an exchange of information on the phenomenology and practical aspects of PNEs through a sixth technical committee meeting in 1980.

PLANS FOR 1981-84

D. 14. The Agency's activities in the field of information exchange may continue through further technical committee meetings and smaller meetings of experts on specific topics.

D. 15. The reports on the status of PNEs, the PNE bibliography and the PNE glossary will be updated when necessary.

D. 16. The Unit for Peaceful Nuclear Explosions Services will continue to be prepared to respond to requests for PNE-related services.

E. FOOD AND AGRICULTURE

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table E.1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	544 341	669 000	42 000	(10 000)	32 000	701 000	795 000
Consultants	18 572	32 000	1 800	(8 800)	(7 000)	25 000	38 500
Overtime	-	300	-	100	100	400	500
Temporary assistance	1 058	2 800	200	(2 000)	(1 800)	1 000	3 300
Sub-total	563 971	704 100	44 000	(20 700)	23 300	727 400	837 300
Common staff costs	150 417	194 500	4 600	(3 000)	1 600	196 100	218 500
Travel	23 056	35 000	2 500	(7 500)	(5 000)	30 000	45 000
Meetings							
Conferences, symposia, seminars	44 561	67 000	4 000	(18 000)	(14 000)	53 000	93 600
Technical committees, advisory groups	54 017	63 000	3 000	18 000	21 000	84 000	87 400
Representation and hospitality	2 854	4 700	300	-	300	5 000	5 200
Scientific and technical contracts	413 066	425 000	21 000	28 500	49 500	474 500	575 000
Common services, supplies and equipment	723	700	-	300	300	1 000	1 000
Other items of expenditure	-	-	-	-	-	-	3 000
Transfer of costs:							
Linguistic services	63 326	104 000	5 000	-	5 000	109 000	145 000
Printing and publishing services	224 344	259 000	15 000	6 000	21 000	280 000	315 000
Data processing services	6 088	25 000	500	1 500	2 000	27 000	30 000
Laboratory services	806 177	1 105 000	55 000	(30 000)	25 000	1 130 000	1 143 000
TOTAL	2 352 600	2 987 000	154 900	(24 900)	130 000	3 117 000	3 499 000

SUMMARY OF MANPOWER

Table E.2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
D	- (1) ^{a/}	- (1)	- (1)	-	- (1)	- (1)
P-5	7 (2)	7 (2)	7 (2)	-	7 (2)	8 (2)
P-4	6 (3)	6 (3)	6 (3)	-	6 (3)	6 (4)
P-3	1 (-)	1 (-)	1 (-)	-	1 (-)	1 (-)
P-2	1 (-)	1 (-)	1 (-)	-	1 (-)	1 (-)
Sub-total	15 (6)	15 (6)	15 (6)	-	15 (6)	16 (7)
GS	8 (6)	8 (6)	8 (6)	-	8 (6)	8 (7)
TOTAL	23 (12)	23 (12)	23 (12)	-	23 (12)	24 (14)

a/ FAO staff in brackets.

Contribution by FAO towards the financing of the activities
of the Joint FAO/IAEA Division

Table E.3

	Budget 1976-77	Estimates 1978-79
Salaries and common staff costs for Professional staff	546 000 ^{a/}	634 000
Consultants	46 000	58 000
Duty travel	24 000	30 000
Contractual services and equipment	214 000 ^{a/}	327 000
Operating expenses	21 000	26 000
Publications	49 000	55 000
TOTAL	900 000^{b/}	1 130 000

^{a/} The cost of meetings is included under Salaries and common staff costs and Contractual services on the basis of CCAQ's expenditure classification.

^{b/} Was originally \$1 180 000.

CHANGES IN COSTS AND MANPOWER

Costs

E.1. As will be seen from Table E.1 above, it is expected that the cost of this programme will increase by \$130 000 as a net result of salary and other price increases of \$154 900 partly offset by a programme decrease of \$24 900.

E.2. A programme decrease of \$13 000 in respect of salaries for established posts and common staff costs reflects the intention to delay the recruitment of new staff to replace departing staff members. Further programme decreases are foreseen in respect of consultants' services (\$8800), temporary assistance (\$2000) and duty travel (\$7500).

E.3. The programme increase of \$18 000 in respect of technical committees and advisory groups is attributable to the addition of one meeting; three meetings were foreseen in the 1978 budget, but it is planned to hold four in 1979. This increase is offset by a programme decrease of \$18 000 in respect of symposia and seminars which is mainly due to the fact that the number of meetings planned for 1979 is one less than in the 1978 budget.

E.4. A programme increase of \$28 500 is foreseen in respect of scientific and technical contracts. The amount includes the annual contribution of \$25 000 which the Agency will make to IFFIT.

E.5. With regard to service costs, programme increases of \$6000 for printing and publishing services and \$1500 for data processing services will be more than offset by a reduction of \$30 000 in respect of laboratory services.

E.6. The contribution from FAO towards the financing of the Joint FAO/IAEA Division's activities during 1978-79 will be \$1 130 000, as shown in Table E.3 above. SIDA will support the research contracts programme with a contribution of \$295 000.

E. 7. The support of the Federal Government of Germany for activities relating to nitrogen residues and tsetse fly control will continue in 1979, with a total contribution of \$496 000. It is also expected that the United States will continue to support the tsetse fly project, with a contribution of \$30 000; the Belgian Government will continue to support this project, with a contribution of about \$62 000.

Manpower

E. 8. No change in manpower is planned for 1979.

E. 9. For 1980 the addition of one Professional post at the P-5 level is foreseen for the project leader of the International Facility for Food Irradiation Technology (IFFIT), at Wageningen, in the Netherlands.

THE PROGRAMME

OBJECTIVE

E. 10. The objective is to foster - in a situation characterized by a slower growth of world food production than of world population and aggravated in recent years by a scarcity and rises in the prices of many agricultural products - applications of isotopes and radiation in food and agriculture under a joint FAO/Agency programme aimed at increasing the ability of developing countries to apply nuclear techniques (when necessary in combination with other advanced methods) in research and development, so as to increase agricultural production, improve food quality, reduce post-harvest losses and minimize pollution of food and the environment.

STRUCTURE

E. 11. This programme consists of six sub-programmes, which are dealt with separately below (advisory groups are referred to as "expert panels" in the programme of FAO).

Summary of manpower and costs by sub-programme

Table E. 4

Sub-programme	1979 Estimate			1980 Preliminary estimate		
	Man-years P	GS	Costs	Man-years P	GS	Costs
Soil fertility, irrigation and crop production	4.2 (0.2) ^{a/}	1.4 (1.1)	781 000	4.2 (0.2)	1.4 (1.1)	769 000
Plant breeding and genetics	2.2 (1.2)	1.4 (1.2)	546 000	2.2 (1.2)	1.4 (1.2)	736 000
Animal production and health	1.2 (1.1)	1.3 (0.2)	297 000	1.2 (1.1)	1.3 (1.2)	280 000
Insect and pest control	2.1 (1.2)	1.3 (1.2)	883 000	2.1 (2.2)	1.3 (1.2)	910 000
Chemical residues and pollution	1.2 (2.1)	2.2 (0.2)	199 000	1.2 (2.1)	2.2 (0.2)	255 000
Food preservation	4.1 (0.2)	0.4 (2.1)	411 000	5.1 (0.2)	0.4 (2.1)	549 000
TOTAL	15.0 (6.0)	8.0 (6.0)	3 117 000	16.0 (7.0)	8.0 (7.0)	3 499 000

^{a/} FAO staff in brackets.

SUB-PROGRAMMES

Soil fertility, irrigation and crop production

OBJECTIVE

E. 12. The objective is to advise and assist Member States of the Agency and FAO in connection with the application of isotope and radiation techniques in problem-oriented research on soil fertility, crop production and irrigation and in the improvement of soil and water management practices, with a view to improving the quality of crops and increasing crop production in the most economic way.

PLANS FOR 1979-84

E. 13. Research projects relating to the efficiency of fertilizer and water utilization by agricultural crops will continue. The programme on micronutrient deficiencies in flooded soils used for rice cultivation will be phased out during the period 1979-80; the one on the fate of nitrogen fertilizer residues will continue until 1980; and the programme on biological dinitrogen fixation and the one aimed at developing efficient practices for water management under dry-farming conditions in semi-arid areas will continue until 1983.

E. 14. During the period 1979-80, programmes aimed at the development of efficient fertilizer and water management practices for different cropping systems - such as multiple cropping, crop rotation and intercropping (which is being increasingly used as a means of achieving more intensive land utilization) - will be initiated. The evaluation of fertilizer management practices in the case of specific tree crops is also envisaged. In 1980, a project relating to the effects of water quality on the water requirements of crops (with special reference to saline soils and to the management of salt accumulation, including the development of leaching methods) will be initiated. It is planned to formulate in 1980 a programme for developing fertilizer and water management practices aimed at improving pastures with a view to the optimization of animal nutrition.

E. 15. A review of recent developments in the use of nuclear methods in soil physics, irrigation and drainage research is planned for 1980. Current and potential applications of isotope and radiation techniques in soil and water conservation research in the countries of Africa will be reviewed in 1979.

E. 16. It is planned to hold annual training courses on the use of isotopes and radiation techniques in soil-water-plant research; in alternate years, emphasis will be placed on the study of soil fertility and soil-plant relationships and on soil moisture and irrigation studies.

STRUCTURE

E. 17. This sub-programme (with which over 20 technical assistance projects are associated at present) consists of four components, which are described in the following paragraphs.

Soil fertility, irrigation and crop production

Summary by programme components

Table E. 5

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Use of isotopes and radiation in studies on plant nutrition and fertilizer application	1.3(0.1) ^{a/}	0.4(0.3)	70 000	21 000	40 000	2 000	133 000
Use of isotopes and radiation in studies of soil-water regimes	1.3(-)	0.4(0.3)	69 100	25 000	30 000	1 900	126 000
Use of isotopes and radiation in studies of ion and water movement in soils	1.3(0.1)	0.4(0.3)	68 500	-	20 000	1 500	90 000
Use of nuclear techniques in improving pasture management and animal production practices	0.3(-)	0.2(0.2)	17 700	-	5 000	1 300	24 000
Linguistic services	-	-	-	-	-	30 000	30 000
Printing and publishing services	-	-	-	-	-	50 000	50 000
Data processing services	-	-	-	-	-	8 000	8 000
Laboratory services	-	-	-	-	-	320 000	320 000
TOTAL	4.2(0.2)	1.4(1.1)	225 300	46 000	95 000	414 700	781 000

a/ FAO staff in brackets.

Use of isotopes and radiation in studies on plant nutrition and fertilizer application

Objective

E. 18. The objective is to develop methods of diagnosing and correcting micronutrient (mainly zinc) deficiencies in flooded soils used for growing rice (1974-79) and to investigate the role of microbiological processes in supplying plants with nitrogen, both symbiotically and non-symbiotically (1978-83).

Results to date

E. 19. In the co-ordinated research programme on micronutrients (Table E. 11, No. 3), following analyses of grain, plants and soils collected from rice fields representative of major rice-growing regions in the countries participating in the programme, zinc deficiency was confirmed in Egypt, India, the Republic of Korea, Pakistan, the Philippines, Thailand and the United States. Indications of copper deficiency were reported from Thailand, the Republic of Korea, Pakistan and Sierra Leone. A significant result of the programme is that, for the first time in many participating countries, analytical data on available zinc and other micronutrients in soils and plants from representative rice-growing tracts now exist. In the study of soil analysis methods for identifying zinc deficiency, DTPA and hydrochloric acid were found to be the most promising extractants for use in predicting the zinc status of flooded rice soils; zinc in the extracts correlated well with plant zinc. Using zinc-65, it was found that zinc sulphate application to the soil surface and addition to the water were more effective in Thailand and Egypt than mixing zinc sulphate with the soil, whereas in Pakistan and India mixing with the soil was the more effective. Results have also indicated

that zinc sulphate was superior to ZnEDTA as a source of zinc for rice grown on flooded soils. Current activities are centred on field experiments (using fertilizers labelled with zinc-65) for comparing the efficiency of various zinc fertilizer application methods and zinc sources in the case of rice grown on flooded, zinc-deficient soils. The residual effects of the applied zinc will also be studied.

E. 20. In the co-ordinated research programme on dinitrogen fixation (Table E. 11, No. 4), which is supported by the Government of Sweden, emphasis will be placed on comparative testing of the methods for measuring dinitrogen fixation in the field, with a view to achieving greater reliability. As symbiotic dinitrogen fixation is the most important process by which leguminous crops are supplied with nitrogen, the programme will be directed mainly towards increasing leguminous crop yields through the development of management practices which will ensure conditions favourable for dinitrogen fixation. Nitrogen fixation through associations between bacteria and non-leguminous crops and the value of blue-green algae in rice cultivation will also be studied.

E. 21. The co-ordinated research programme on the efficiency of fertilizer utilization by grain legumes (Table E. 11, No. 1) has been phased out and work has started on preparation of the results for publication in the Agency's Technical Reports Series.

E. 22. Plans have been finalized for an interregional seminar on the use of isotopes and ionizing radiation in the study of soil-plant relationships, to be held at Seibersdorf from April to June.

Plans for 1979-80

E. 23. The micronutrient programme will be phased out in 1979-80 and the results published. The dinitrogen fixation programme will be directed towards the development of a methodology for measuring dinitrogen fixation in the field and towards defining the conditions most favourable for this process.

E. 24. A programme concerning the development of efficient fertilizer management practices for different cropping systems, including trees, will be initiated (Advisory Group - Annex II (73)).

E. 25. The Agency's Laboratory will carry out supporting research, provide training in methodology and perform nitrogen-15 and other determinations for this component.

Plans for 1981-84

E. 26. The dinitrogen fixation programme and the programme concerning efficient fertilizer management practices will continue.

Co-operation with other organizations

E. 27. This programme component involves co-operation with UNDP, SIDA, IRRI, ESNA, ICRISAT, IITA and the International Soil Science Society.

Use of isotopes and radiation in studies of soil water regimes

Objective

E. 28. The objective is to develop efficient practices of water management under dry-farming conditions in semi-arid areas (1979-84).

Results to date

E. 29. In the co-ordinated research programme on soil water dynamics (Table E. 11, No. 2), soil moisture changes in representative soil profiles in Member States have been followed with neutron moisture meters and hydraulic conductivity determined as a

function of soil moisture content for different soil types; the amount of water lost through drainage has been estimated and water balances have been established. The results (expected to be published in the Agency's Technical Reports Series) have served as a basis for the development of practices aimed at increasing crop yields, reducing water losses and avoiding salt accumulation near the soil surface. Current activities are directed towards greater soil water retention under dry-farming conditions in semi-arid regions (through increased water infiltration, reduced evaporation and the application of organic matter) and towards the collection and storage of water for subsequent use and the enhanced efficiency of water use by crops.

Plans for 1979-84

E. 30. A co-ordinated research programme on isotope and radiation techniques for helping to achieve efficient water and fertilizer use in semi-arid regions is expected to get under way early in 1979 (Table E. 11, No. 5). Developments in the application of isotope and radiation techniques in soil physics research and in irrigation and drainage studies will be reviewed in 1980 (Symposium - Annex III (7)).

Related Activities

E. 31. Training in the use of nuclear techniques in soil and water conservation studies, with special reference to the problems of countries in Africa, will be organized in 1979 (Seminar - Annex I (10)).

Co-operation with other organizations

E. 32. This programme component involves co-operation with UNDP, IITA, ICRISAT and EAAFRRO.

Use of isotopes and radiation in studies of ion and water movement in soils

Objective

E. 33. The objective is to develop (in collaboration with the "Chemical residues and pollution" sub-programme) water and soil management practices which will maximize the utilization of fertilizer nitrogen residues by crops (1975-80).

Results to date

E. 34. Work has been directed towards understanding the long-term fate of fertilizer nitrogen in the soil-air-water-plant ecosystem. The co-ordinated research programme in this field (Table E. 11, No. 8), which is supported by the Government of the Federal Republic of Germany and is being conducted in collaboration with the "Chemical residues and pollution" sub-programme, involves determining the uptake of both soil and fertilizer nitrogen by crops, the residual value of fertilizer nitrogen for subsequent crops, the quantities of residual fertilizer nitrogen (in inorganic and organic forms) within the rooting zone, losses of gaseous nitrogen to the atmosphere and losses of nitrogen through leaching below the rooting zone; results for at least five years are required for arriving at meaningful conclusions on the fate of fertilizer nitrogen residues in the terrestrial food chain.

Plans for 1979-84

E. 35. The results of the co-ordinated research programme, which are to be reviewed at a seminar planned for 1980 (Seminar), will be published in 1981.

Related activities

E. 36. The Agency's Laboratory will undertake supporting research, provide training and assist contractors with analyses.

Co-operation with other organizations

E. 37. This programme component involves co-operation with UNDP, GSF, ICRISAT and EAAFR0.

Use of nuclear techniques in improving pasture management and animal production practices

Objective

E. 38. The objective is to develop (in collaboration with the "Animal production and health" sub-programme) fertilizer and water management practices for improving pastures in order to optimize animal nutrition (1980-85).

Plans for 1979-84

E. 39. A detailed technical programme for and an experimental approach (including the use of isotopic tracer techniques) to improving forage production through better fertilizer and water management practices will be formulated in 1980 (Advisory Group). In the initial stages of the programme, emphasis will be placed on studying the efficiency of forage legumes as suppliers of nitrogen for the soil-plant-animal system in improved pastures. The potential benefits of improved pastures in terms of animal nutrition will be examined in collaboration with the "Animal production and health" sub-programme. This component will be executed through a co-ordinated research programme in which approximately ten institutions in Member States will participate.

Related activities

E. 40. The Agency's Laboratory will provide training in methodology and assist contractors with analyses.

Co-operation with other organizations

E. 41. This programme component will involve co-operation with UNDP, UNEP and ICRISAT.

Plant breeding and genetics

OBJECTIVE

E. 42. The objective is to assist and advise Member States of the Agency and FAO in connection with the use of radiation and isotope techniques - based on concepts, procedures and methods developed through research - for the genetic improvement of crop plants.

PLANS FOR 1979-84

E. 43. The provision of assistance and advice to Member States will continue by means of correspondence, missions, training, conferences and publications. Research necessary in connection with the provision of advice will continue - administered through co-ordinated research programmes, guided by means of technical assistance projects or carried out at the Agency's Laboratory. The research programme will focus on the development of more efficient and economic systems for mutation induction and for the selection and utilization of mutants. The efforts to supply, by mutation induction, genetic stocks for use by plant breeders will continue. Priority will be given to the main food crops, including fruits and vegetables, and to certain industrial crops. Attention will be paid to achieving greater yields, better nutritional quality and higher resistance to disease and pests. Techniques will be improved in the light of advances in cytogenetics, molecular biology, in vitro culture work, plant physiology and biochemistry. Training courses on various aspects of mutation breeding methodology are planned.

STRUCTURE

E. 44. This sub-programme (with which about ten technical assistance projects are associated at present) consists of four components, which are described in the following paragraphs.

Plant breeding and genetics

Summary by programme components

Table E. 6

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Grain protein improvement by means of nuclear techniques	0.6(0.3) ^{a/}	0.4(0.3)	39 400	-	20 000	1 600	61 000
Disease and pest resistance of crop plants	0.6(0.3)	0.4(0.3)	39 400	-	20 000	1 600	61 000
Crop improvement through induced mutations	0.5(0.3)	0.3(0.3)	34 400	-	20 000	1 600	56 000
Development of induced mutation technology	0.5(0.3)	0.3(0.3)	33 500	-	13 000	1 500	48 000
Linguistic services	-	-	-	-	-	20 000	20 000
Printing and publishing services	-	-	-	-	-	23 000	23 000
Data processing services	-	-	-	-	-	7 000	7 000
Laboratory services	-	-	-	-	-	270 000	270 000
TOTAL	2.2(1.2)	1.4(1.2)	146 700	-	73 000	326 300	546 000

^{a/} FAO staff in brackets.

Grain protein improvement by means of nuclear techniques

Objective

E. 45. The objective is to increase the protein content of cereal grains and achieve better protein quality through mutation induction (started 1970), to select promising mutants, to evaluate the selected mutants genetically, nutritionally and agronomically (1972-82) and to use them in cross-breeding (1970-84).

Results to date

E. 46. A report on the results of the co-ordinated research programme on the use of aneuploids for wheat protein improvement (Table E. 11, No. 18) is being published this year in the Agency's Panel Proceedings Series.

E. 47. In a co-ordinated research programme initiated in 1971 (Table E. 11, No. 13) and supported by the Federal Republic of Germany, mutants of barley and rice with improved nutritional quality have been obtained and are being used extensively in the cross-breeding programmes of leading breeding institutes. Analytical techniques for use in plant breeding programmes have been developed and standardized. Several mutants have been investigated genetically and evaluated in feeding trials. The results achieved will be reviewed at a symposium this year.

Plans for 1979-80

E. 48. Although the latter co-ordinated research programme is being phased out this year, 25 co-operating institutes will continue through individual projects to work on the practical utilization of selected mutants. Subject to the availability of funds, the Agency will provide for continued co-ordination until the end of 1982.

Related activities

E. 49. The Agency's Laboratory will serve projects through the provision of analytical services (particularly protein and legume analysis on a routine basis) and advice.

Plans for 1981-84

E. 50. The valuable genetic stocks developed will be handed over for use in cross-breeding in national and international programmes with similar objectives, such as the FAO/SIDA programme for increasing the nutritional value of spring wheat and barley. Subject to the availability of funds, a modified programme focusing on increasing the nutritional value of food and feed crops other than cereals will be developed.

Co-operation with other organizations

E. 51. This programme component involves co-operation with GSF, USDA, the United States Department of Energy, SIDA and several international agricultural research centres.

Disease and pest resistance of crop plants

Objective

E. 52. The objective is to create, through mutagenesis, genetic variability for selecting crop plants with improved disease resistance (1977-84) and to create, through mutagenesis, genetic variability for selecting crop plants with improved resistance to disease vectors and harmful insects (1979-89) (in collaboration with the "Insect and pest control" sub-programme).

Results to date

E. 53. This is a new programme component; it has evolved from a co-ordinated research programme which started with SIDA support in 1970 (Table E. 11, No. 14). From research carried out under this programme, sources of resistance have been identified and are in use in breeding programmes. Detailed results were reported at an Agency symposium in 1977.

Plans for 1979-80

E. 54. Substantial funds provided by SIDA will permit an expansion of activities. In particular, attention will be paid to research aimed at increasing disease resistance in grain legumes (Table E. 11, No. 21). Efforts will be made to initiate a programme on resistance to damaging insects and other disease vectors (in collaboration with the "Insect and pest control" sub-programme, under the component entitled "Use of isotopes and radiation in insect pest management").

Related activities

E. 55. The Agency's Laboratory will provide support through mutagen treatment services and methodological research and training; the Entomology Laboratory will also render assistance when necessary.

Plans for 1981-84

E. 56. Subject to the availability of funds, work on developing genetic resistance to damaging insects and other disease vectors is planned for a ten-year period; it would

involve approximately twenty research institutes concerned with different crop plants, different disease and pest problems and different aspects of resistance.

Co-operation with other organizations

E. 57. This programme component involves co-operation with several national and international integrated plant protection programmes, such as those co-ordinated by UNEP, IOBC, the International Biological Programme, USDA and international agricultural research centres.

Crop improvement through induced mutations

Objective

E. 58. The objective is to induce mutations and select and evaluate mutants having improved characteristics and to use them for developing improved cultivars (1969-continuing), with emphasis on improving vegetatively propagated plants and woody perennials through somatic mutations (1972-82), improving productivity components of grain legumes and oil crops (1977-84) and broadening the genetic basis for short-stature cereals (1978-82), and to collect information about valuable mutant stocks and disseminate it through the "Mutation Breeding Newsletter" (1972-continuing).

Results to date

E. 59. A number of crop plant varieties with desirable traits obtained through mutation induction are already in practical use in Member States, and many other mutant lines are available for use by plant breeders. Several crop cultivars have been derived from mutants either through direct propagation or through cross-breeding.

E. 60. The co-ordinated research programme on the use of induced mutations in rice breeding (Table E. 11, No. 15) has led to the development of high-yielding, early-maturing rice strains which have been released as new commercial varieties in several countries.

E. 61. The "Mutation Breeding Newsletter", issued twice a year, has continued to inform scientists and practical plant breeders of advances in mutation and selection technology, available improved genetic stocks and mutant-derived varieties released for commercial use.

Plans for 1979-80

E. 62. The co-ordinated research programme aimed at increasing the productivity of grain legumes in South East Asia (Table E. 11, No. 19) is planned to continue until 1981-82. Research work on the improvement of vegetatively propagated plants and woody perennials (Table E. 11, No. 17), a programme of particularly long duration, is also planned to continue until 1981-82.

E. 63. A co-ordinated research programme focusing on the genetic diversification of crop plants and the incorporation of desired mutant genes into suitable, highly productive genotypes (Table E. 11, No. 20) is starting this year and will continue initially for five years.

E. 64. A programme for improving oil seeds and other industrial crops will be formulated in 1980 (Advisory Group).

Related activities

E. 65. This programme component is closely related to a number of technical assistance projects with similar aims.

Plans for 1981-84

E. 66. Subject to the availability of funds, two training courses, one study tour and one symposium relating to the improvement of crops through induced mutations will be organized.

Co-operation with other organizations

E. 67. This programme component involves co-operation with EUCARPIA, SABRAO and other plant-breeding/plant genetics associations.

Development of induced mutation technology

Objective

E. 68. The objective is to gain further insight into the action of mutagens on plant material, to develop appropriate techniques for identifying mutants with improved characteristics and to examine the genetic basis of mutated traits (1969-continuing); and to develop in vitro methods for mutation induction and mutant selection and to find ways of altering cytoplasmically inherited traits (1977-84).

Results to date

E. 69. Mutagen treatments of different plant species and different plant organs require a knowledge of the sensitivity of the plant material, of ways of applying mutagens, of methods for controlling modifying factors and of standardized means for assessing the effectiveness of mutagenesis; in all these areas, useful results have been obtained by research institutes in Member States and by the Agency's Laboratory. Powerful new mutagens have been discovered and methods for the safe handling of these dangerous compounds have been worked out and publicized in the 1977 revised edition of the "Manual on Mutation Breeding" (published in the Agency's Technical Reports Series).

Plans for 1979-80

E. 70. Research work will be directed at providing the technology necessary for progress in crop improvement through mutation induction (Table E. 11, No. 16). Co-ordinated research programmes with practical breeding objectives (Table E.11, Nos 14,17 and 19) will include work (carried out mainly through cost-free research agreements) on the development of induced mutation technology, including techniques for detecting mutants.

Related activities

E. 71. Subject to the availability of funds, a training course on mutation breeding technology will be held during the period 1979-80.

E. 72. The Agency's Laboratory will continue to carry out supporting research and to provide training and mutagen treatment services.

Plans for 1981-84

E. 73. A symposium on the use of mutation induction as an analytical tool in plant research will be proposed for 1981.

E. 74. More emphasis will be placed on mutation techniques involving haploid plants and in vitro cultures. The state of knowledge concerning the induction of mutations in genetic traits inherited in ways other than through chromosomes will be reviewed and guidelines for Agency action formulated.

Co-operation with other organizations

E. 75. This programme component involves co-operation with EURATOM, ESNA, the Indian Society for Nuclear Techniques in Agriculture and Biology and various plant genetics associations.

Animal production and health

OBJECTIVE

E. 76. The objective is to assist and advise Member States of the Agency and FAO in connection with the use of nuclear techniques for the solution of animal production and disease problems, including problems associated with nutrition, reproduction and adaptation to the environment.

PLANS FOR 1979-84

E. 77. The work under this sub-programme will be directed towards the application of radioisotopes in studying practical animal production and health problems. The improvement of animal production and health through research with isotopes will be a subject for discussion at symposia, seminars, research co-ordination meetings and advisory group meetings. Co-ordinated research programmes will concentrate on the use of isotopes in detecting moderate mineral imbalances, the use of radioimmunoassay techniques to increase reproductive efficiency, the use of tritiated water in studying water metabolism in tropical herbivores, the use of isotopes in studies related to the control of ticks and tick-borne diseases, the use of radioisotopes in increasing domestic buffalo production and the use of radioisotopes and radiation in animal parasitology and immunology.

E. 78. Advanced training courses on the use of radioisotopes in animal parasitology and immunology, on radioimmunoassay techniques in animal production research and on the use of radioisotopes in mineral metabolism studies and training courses on the use of nuclear techniques in animal health and animal production research are planned.

E. 79. A programme on aquatic animal production and disease research, a field of increasing importance in many Member States, will be formulated.

STRUCTURE

E. 80. This sub-programme (with which about seventeen technical assistance projects are associated at present) consists of two components, which are described in the following paragraphs.

Animal production and health

Summary by programme components

Table E. 7

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Isotope techniques in animal nutrition and physiology	0.6(0.6) ^{a/}	0.7(0.1)	46 500	-	40 000	2 500	89 000
Nuclear techniques in animal disease control and parasitology	0.6(0.5)	0.6(0.1)	45 100	49 000	47 000	2 900	144 000
Linguistic services	-	-	-	-	-	10 000	10 000
Printing and publishing services	-	-	-	-	-	50 000	50 000
Data processing services	-	-	-	-	-	4 000	4 000
TOTAL	1.2(1.1)	1.3(0.2)	91 600	49 000	87 000	69 400	297 000

a/ FAO staff in brackets.

Isotope techniques in animal nutrition and physiology

Objective

E. 81. The objective is to determine - by studying water metabolism - why certain species and breeds are more adaptable to environmental extremes, such as water restriction, than others (1974-79), to develop isotopic methods for detecting moderate mineral imbalances (1976-81) and to evaluate - using radioimmunoassay and related techniques - hormonal dysfunctions in relation to reproductive capabilities in farm animals (1976-81).

Results to date

E. 82. Three research co-ordination meetings have been held in connection with the co-ordinated research programme on the use of tritiated water in studying water metabolism (Table E. 11, No. 22), which is being supported by the Government of Sweden and is progressing well. One research co-ordination meeting has been held in connection with the co-ordinated research programme on radioimmunoassay procedures (Table E. 11, No. 24) and one in connection with the programme on the use of radioisotopes in detecting moderate mineral imbalances (Table E. 11, No. 25). Although these programmes are in an early stage, practical results in terms of improved animal feed management and increased reproductive efficiency have been reported.

E. 83. A training workshop was held in conjunction with the research co-ordination meeting on radioimmunoassay procedures and an interregional training course on the use of radioisotopes in animal research was held in Peru in 1977.

E. 84. The "Laboratory Training Manual on the Use of Radionuclides and Radiation in Animal Research" has been revised and will appear in the Agency's Technical Reports Series under the title "Laboratory Training Manual on the Use of Nuclear Techniques in Animal Research".

Plans for 1979-80

E. 85. Under the co-ordinated research programme on the use of tritiated water in studying water metabolism, the emphasis will be on identifying tropical herbivore strains which can maintain production under conditions of water restriction. A second research co-ordination meeting in connection with the co-ordinated research programme on the use of radioisotopes in detecting moderate mineral imbalances and an advanced training course on the use of isotopes in mineral metabolism studies are planned for 1979; the emphasis in the training course will be on identifying simple radioisotope techniques for the detection of moderate mineral imbalances which limit livestock production. A third research co-ordination meeting in connection with the co-ordinated research programme on radioimmuno-assay procedures will also be held.

E. 86. The possibility of using radioisotope methods in aquatic animal production and disease research will be considered in 1980 (Advisory Group).

Related activities

E. 87. Animal nutrition and physiology problems are being studied within the framework of technical assistance projects in Brazil, Cuba and Yugoslavia, and projects in other countries are to be initiated soon; a training course is planned to take place in Cuba in 1979.

Plans for 1981-84

E. 88. The techniques employed and results obtained in the programme on the use of radioisotopes for detecting moderate mineral imbalances will be used in determining whether production disease associated with the intensification of agriculture in developing countries is partly a result of mineral deficiencies; the techniques could be used to detect several moderate mineral deficiencies simultaneously. Radioimmunoassay techniques will be used to assess fertility in domestic animals reared in harsh environments; the information obtained will be used in developing programmes for increasing reproduction through synchronization of the oestrous cycle.

E. 89. A co-ordinated research programme on the use of radioisotopes in aquatic animal production and disease research is planned.

Co-operation with other organizations

E. 90. This programme component involves co-operation with UNDP, SIDA, ILCA and the Centro Internacional de Agricultura Tropical in Colombia.

Nuclear techniques in animal disease control and parasitology

Objective

E. 91. The objective is to develop - through pathophysiological and immunological studies - diagnostic techniques for the early detection of disease (1976-81), to improve buffalo production by investigating nutritional, reproductive and disease problems which prevent increased production (1978-83) and to investigate the epizootiology of tick-borne diseases and devise control measures against ticks (1976-83).

Results to date

E. 92. An international training course on the use of isotopic techniques in animal parasitology and immunology was held at ILRAD, in Kenya, in 1978. In conjunction with this course, the first research co-ordination meeting of the co-ordinated research programme in connection with the use of isotopes and radiation in the control of ticks and tick-borne diseases (Table E. 11, No. 26) was held.

Plans for 1979-80

E. 93. Questions concerning animal disease vectors, host-pathogen relationships and the environmental impact of control procedures will be reviewed in 1979 (Symposium - Annex I (11)).

E. 94. Plans for a co-ordinated research programme on the use of radioisotopes in animal parasitology and immunology will be formulated in 1979 (Advisory Group - Annex II (74)). The first research co-ordination meeting in connection with the co-ordinated research programme on the use of radioisotopes in domestic buffalo disease and production research (Table E. 11, No. 23) will be held in the same year. The second research co-ordination meeting in connection with the co-ordinated research programme on the use of isotopes and radiation in the control of ticks and tick-borne diseases will be held in 1980.

Related activities

E. 95. Support will be provided for technical assistance projects in several countries through help in planning and executing programmes for the diagnosis, control and eradication of parasitic diseases. Support will also be provided for technical assistance projects relating to buffalo production, which are expected to be initiated in several countries.

Plans for 1981-84

E. 96. Efforts will centre on gaining a better understanding of the pathophysiology of tick-borne diseases such as anaplasmosis, babesiosis and theileriasis and on developing procedures for controlling and eradicating them. With regard to buffalo production, efforts will be directed towards investigating infectious diseases and gaining a better understanding of the nutritional requirements of and reproductive disorders in buffaloes.

Co-operation with other organizations

E. 97. This programme component involves co-operation with UNDP, ILRAD and SIDA.

Insect and pest control

OBJECTIVE

E. 98. The objective is to assist and advise Member States of the Agency and FAO in connection with the development of insect and pest control programmes involving radiation and isotopes, insect control being the subject of the sub-programme at present.

PLANS FOR 1979-84

E. 99. In the use of the sterile-insect technique (SIT) for the control of plant-feeding insects, the emphasis will be on field applications and related questions. Additional plant-feeding insects will be considered in the light of the recommendations of advisory groups. Technical support will be given to large-scale Mediterranean fruit fly (medfly) control campaigns based on the integration of SIT with other control methods. The Mexico-USA medfly programme will continue to receive technical support. Methods for optimizing SIT as a procedure for excluding insect pests from pest-free areas will be developed; in this connection, a co-ordinated research programme on the use of genetic mechanisms such as sex ratio distortion is planned. The co-ordinated research programme on the use of SIT for the control of lepidopterous insects which attack tree fruit was terminated in 1977; it has been replaced by a five-year programme on the use of isotopes in pest management (with emphasis on rice insects) which is aimed at developing sound pest control practices through the use of isotopic techniques and will cover various aspects of insect ecology (for example, host plant-insect interactions and host plant succession) and the use of insecticides.

E.100. Tsetse fly rearing technology has advanced at a fast pace and will be applied in Nigeria in a field project which is being supported by Belgium, the Federal Republic of Germany and possibly the United Kingdom. In addition to this project, the Agency's laboratory staff will continue to provide research and technical support to several tsetse fly projects in other African countries.

E.101. The recommendations of an advisory group on the mutation breeding of specific plants to obtain resistance to insect attack are now being evaluated and may form the basis for a programme in this area.

E.102. The information circular "Radiation Techniques and their Application to Insect Pests" will continue to appear, its coverage including mechanisms for the genetic control of plant- and animal-feeding insects, the use of isotopes in pest management and - possibly - mutation breeding for resistance to insects.

E.103. An advisory group meeting on mechanization and quality control in the mass rearing of insects will be proposed for 1981.

E.104. In 1979, questions relating to the use of isotopes in research on and the control of animal disease vectors, host-pathogen relationships and the environmental impact of control procedures will be reviewed in collaboration with the "Animal production and health" and "Chemical residues and pollution" sub-programmes (Symposium - Annex I (11)).

E.105. In general, the programme emphasis will shift to field applications of SIT, to the use of isotopes in pest management systems and to the development of tsetse fly rearing techniques which can be employed in developing countries.

E.106. Training courses on the use of isotopes and radiation in entomology are planned.

STRUCTURE

E.107. This sub-programme consists of three components, which are described in the following paragraphs.

Insect and pest control

Summary by programme components

Table E. 8

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Development of the sterile-insect technique against fruit flies	0.8(0.4) ^{a/}	0.5(0.4)	54 800	-	20 000	2 200	77 000
Development of the sterile-insect technique against the tsetse fly and other biting flies	0.7(0.4)	0.5(0.4)	48 800	21 000	20 000	1 200	91 000
Use of isotopes and radiation in insect pest management	0.6(0.4)	0.3(0.4)	39 200	-	29 000	2 800	71 000
Linguistic services	-	-	-	-	-	15 000	15 000
Printing and publishing services	-	-	-	-	-	84 000	84 000
Data processing services	-	-	-	-	-	5 000	5 000
Laboratory services	-	-	-	-	-	540 000	540 000
TOTAL	2.1(1.2)	1.3(1.2)	142 800	21 000	69 000	650 200	883 000

^{a/} FAO staff in brackets.

Development of the sterile-insect technique against fruit flies

Objective

E. 108. To assist in applying the sterile-insect technique on a large scale against fruit flies and to develop methods for optimizing its application (1968-81).

Results to date

E. 109. Effective exclusion or control of the medfly by SIT has been demonstrated in several countries. At present, a large-scale project in which the Agency is directly involved is being initiated by the Governments of Mexico and the United States.

Plans for 1979-80

E. 110. Techniques (such as sex ratio distortion) for optimizing the field application of SIT against fruit flies and economic mass rearing with minimum labour will be emphasized. Several technical contracts for the development of quality control procedures to supplement those of the Agency's Laboratory will continue.

Related activities

E. 111. The Agency's Laboratory will carry out research and provide training in support of this component.

Plans for 1981-84

E. 112. Work will be done on developing simple quality control procedures for assessing effectiveness of mass-reared flies in the field and on reducing the costs of medfly

production. A manual will be published in 1982 on a methodology for medfly mass rearing based on research carried out at the Agency's Laboratory and practical experience at the mass-rearing facility under construction in Mexico. When the Mexican facility becomes operational and - it is hoped - available for training fellows from various countries in mass rearing and the use of SIT for medfly control and eradication, the emphasis in the Agency's work will shift to other damaging insects.

Co-operation with other organizations

E.113. This programme component involved co-operation with UNDP, EPPO, IOBC, USDA and the Dirección General de Sanidad Vegetal of the Mexican Secretaría de Agricultura y Ganadería.

Development of the sterile-insect technique against the tsetse fly and other biting flies

Objective

E.114. The objective is to develop practices for the field application of the sterile-insect technique in eradicating or controlling the tsetse fly (1970-85) and to develop mass-rearing and sterilization procedures for blood-sucking dipterous insects (1980-85).

Results to date

E.115. Considerable progress has been made in feeding two tsetse fly species through membranes and at least two sources of blood have proved satisfactory. Rearing procedures based on both animal (in vivo) and membrane (in vitro) feeding which reduce labour requirements and increase the uniformity of the product have been developed at Seibersdorf. The sexual competitiveness of flies reared in vivo and in vitro has been studied under laboratory and field conditions.

Plans for 1979-80

E.116. With a view to achieving greater efficiency and reducing costs, the rearing of tsetse flies without living hosts will be developed further, to the point where the methods are readily usable in pilot projects in Africa; the in vivo and in vitro rearing of tsetse flies in relation to the use of SIT will be reviewed in 1979 (Advisory Group - Annex II (75)). Better methods of blood preparation and preservation (such as freeze-drying) will continue to be developed and nutrition problems investigated. The sexual competitiveness of membrane- and animal-fed sterilized tsetse flies will be determined. Ecological studies of some target species will be conducted and methods for rearing and handling them developed. The co-ordinated research programme on tsetse fly control or eradication by SIT (Table E.11, No. 7) will be phased out during the period 1979-80.

Related activities

E.117. The Agency's Laboratory will carry out research and provide training in support of the activities comprising this programme component.

Plans for 1981-84

E.118. The development of tsetse fly mass-rearing technology based on membrane and animal feeding will continue. Particular emphasis will be placed on methods needed for the field project in Nigeria. Tsetse fly projects initiated by national and other international organizations will be supported. Mechanisms (such as sex ratio distortion) of increasing the effectiveness of SIT will be investigated. If the demand warrants it, mass-rearing methods developed for the medfly will be adapted to the stable fly.

Co-operation with other organizations

E. 119. This component includes co-operation with WHO, UNEP, US-AID, GSF, the International Centre for Insect Physiology and Ecology and other organizations.

Use of isotopes and radiation in insect pest management

Objective

E. 120. The objective is to solve important pest management problems, to determine mechanisms of host feeding as it relates to resistant plant varieties (1978-84) (in collaboration with the "Plant breeding and genetics" sub-programme) and to determine the pathogen-vector relationships in animal and plant diseases (1980-85).

Plans for 1979-80

E. 121. A co-ordinated research programme on the use of isotopes in the development of pest management systems (with emphasis on rice insects) will be initiated (Table E. 11, No. 6); contracts and agreements will be concluded mainly with institutes in major rice-growing regions.

E. 122. Assistance in the entomological area will be given in connection with work on disease resistance in crop plants under the programme component entitled "Disease and pest resistance of crop plants", the aim being to devise plant-screening techniques which can be used in developing countries.

Related activities

E. 123. The Agency's Laboratory will carry out research and provide training in support of this component.

Plans for 1981-84

E. 124. Field demonstrations of pest management will be carried out by national organizations using results obtained through the co-ordinated research programme. Interactions between plant and animal disease vectors and their hosts will be investigated using isotope techniques.

Co-operation with other organizations

E. 125. This component involves co-operation with UNDP and IOBC.

Chemical residues and pollution

OBJECTIVE

E. 126. The objective is to assist and advise Member States of the Agency and FAO in connection with the safe and effective use of isotope and irradiation techniques in solving residue and pollution problems of agriculture, forestry, fisheries and food.

PLANS FOR 1979-84

E. 127. Co-ordinated research programmes dealing with the conservation (for soil fertilization) and control (for pollution prevention) of agricultural nitrogen residues, with problems of pesticides and other chemical residues in edible oil seeds and their products in developing countries, with the development and application of isotope techniques for monitoring water quality and studying pollutant-biota interactions in aquatic ecosystems and

with the development and application of isotope techniques for studying the fate of agro-chemical residues in soil and determining the capacity of soil to bring about desirable transformations and to degrade undesirable residues will continue until 1980-82.

E. 128. Programmes will be initiated on interactions between atmospheric pollutants and sensitive crops (with particular reference to sulphur dioxide), on the better utilization of agricultural residues and on the use of environmental-isotope and labelled-substrate techniques for monitoring the impact of various human activities on large agricultural and fishery ecosystems.

E. 129. Summaries of comparative data on inputs, levels, the fate and effects of trace contaminants (including radioactive substances) in agriculture, fisheries and food will continue to be compiled and published as an aid to scientists in developing countries.

E. 130. Support will be provided for technical assistance activities and further training courses are planned.

E. 131. A laboratory manual on nuclear techniques for use in studying chemical residue and pollution problems will be published.

STRUCTURE

E. 132. This sub-programme consists of three components, which are described in the following paragraphs.

Chemical residues and pollution

Summary by programme components

Table E. 9

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Isotope-aided research on agricultural nitrogen residues, with particular reference to their conservation as fertilizers and their behaviour as potential pollutants	0.6(1.2) ^{a/}	1.0(0.1)	45 200	-	30 000	1 800	77 000
Isotope-tracer-aided studies of agricultural and related chemical residues in edible oil seeds and their products and of residue-biota interactions in agriculture and fisheries	0.6(0.7)	1.0(0.1)	44 000	-	27 500	2 500	74 000
Collection and dissemination of comparative data on inputs, levels, the fate and effects of contaminants (including radioactive substances) in agriculture, fisheries and food	- (0.2)	0.2(-)	2 000	-	-	-	2 000
Linguistic services	-	-	-	-	-	20 000	20 000
Printing and publishing services	-	-	-	-	-	23 000	23 000
Data processing services	-	-	-	-	-	3 000	3 000
TOTAL	1.2(2.1)	2.2(0.2)	91 200	-	57 500	50 300	199 000

a/ FAO staff in brackets.

Isotope-aided research on agricultural nitrogen residues, with particular reference to their conservation as fertilizers and their behaviour as potential pollutants

Objective

E. 133. The objective is to develop agrochemical and soil management practices which minimize the pollutant potential of agricultural nitrogen residues and conserve them as a useful fertilizer (1974-80) (in collaboration with the "Soil fertility, irrigation and crop production" sub-programme).

Results to date

E. 134. Important information and data on the behaviour of fertilizer nitrogen not taken up by crops have been obtained through a co-ordinated research programme (Table E. 11, No. 8) supported by the Federal Republic of Germany. Information is being collected on methods for minimizing the pollutant potential of fertilizer nitrogen residues while retaining them as useful fertilizer in the crop root zone and on nitrogen losses through leaching and volatilization.

Plans for 1979-80

E. 135. The co-ordinated research programme will be terminated and a comprehensive report with practical recommendations concerning soil management and environmental quality protection prepared in 1980 (Seminar).

Related activities

E. 136. Support to developing countries will continue to be provided through technical assistance, training and the dissemination of information.

Co-operation with other organizations

E. 137. Co-operation and liaison will continue with organizations such as UNEP and GSF and in such important national and international activities as the RANN (Research Applied to National Needs) project in California and UNESCO's "Man and the Biosphere" programme.

Isotope-tracer-aided studies of agricultural and related chemical residues in edible oil seeds and their products and of residue-biota interactions in agriculture and fisheries

Objective

E. 138. The objective is to develop methods for determining pesticide and other chemical residues in edible oil seeds and those of their products which are of importance to developing countries (1974-80), to develop isotope techniques for monitoring and protecting the quality of inland water bodies (1975-80) and to develop isotope techniques as a monitoring tool for use in determining soil quality and the capacity of soil to degrade undesirable chemical residues and pollutants (1977-82).

Results to date

E. 139. New and useful data have been obtained on the appearance and levels of insecticide residues in cotton and other edible oil seeds and their products following insecticide control measures under field conditions; results have been published and transmitted to the FAO/WHO Secretariat on Pesticide Residues. The use of labelled-substrate techniques for monitoring water quality and detecting residues has proved successful in several countries.

Plans for 1979-80

E. 140. Work on problems of chemical residues in developing countries will be supported, with the help of SIDA, through co-ordinated research programmes (Table E. 11, Nos 9-12). Progress in and the status of studies of atmospheric pollutant-crop interactions will be reviewed in 1980 (Advisory Group).

Related activities

E. 141. Support for developing countries will be provided through technical assistance and training activities.

Plans for 1981-84

E. 142. Recommendations on techniques for soil and water monitoring, especially in large ecosystems exposed to major changes in agricultural practice (such as changes involving deforestation) will be published, and advice will be given on the use of techniques for detecting important changes in the quality of soil and water as a result of factors such as large-scale changes in drainage area management practices, deforestation and air-borne pollution.

Co-operation with other organizations

E. 143. Besides close liaison with SIDA, co-operation will be maintained with other United Nations organizations (for example, UNESCO - under its "Man and the Biosphere" programme, WHO, UNEP and UNSCEAR), with intergovernmental organizations (for example, EPPO and EURATOM) and with non-governmental organizations (for example, the International Academy of Environmental Safety and ESNA).

Collection and dissemination of comparative data on inputs, levels, the fate and effects of contaminants (including radioactive substances) in agriculture, fisheries and food

Objective

E. 144. The objective is to compile, evaluate and make a comparative review - on the basis of a provisionally established uniform scheme - of data on foreign chemicals (including radioactive substances) which appear in food, the environment and the tissues of organisms (1973-continuing).

Results to date

E. 145. A number of summaries dealing with individual substances such as insecticides and radionuclides and with groups of substances such as all herbicides and all fertilizers have been compiled and published by an international journal on a cost-free basis.

Plans for 1979-84

E. 146. Further summaries will be prepared and published, and a monograph in the form of a collection of all summaries, including a glossary of important terms and definitions, is planned as an aid to environmental scientists in developing countries.

Related activities

E. 147. Liaison and information exchange will be maintained with national and international environmental information centres (for example, those co-ordinated by UNEP and the United States Environmental Protection Agency).

Food preservation

OBJECTIVE

E.148. The objective is to assist and advise Member States of the Agency in connection with facilitating the practical application of food irradiation where it produces a wholesome product and offers clear economic, technological and environmental advantages and, in the light of the fact that these requirements appear to have been met for a number of foods, to achieve, in collaboration with WHO and FAO, general acceptance of the food irradiation process.

PLANS FOR 1979-84

E.149. Emphasis will be placed on clarifying, in collaboration with WHO, some outstanding wholesomeness questions and on the practical application of food irradiation in Member States.

E.150. The provision of training and technological-scale studies of technical problems and economic feasibility will continue and be intensified through the establishment of the International Facility for Food Irradiation Technology at Wageningen in the Netherlands.

E.151. Efforts will be made through the Codex Alimentarius Commission of the FAO/WHO Food Standards Programme to achieve a global consensus on the public health acceptance and the industrial introduction of food irradiation as a preservation technique. World-wide approval of the food irradiation process by public health authorities will be a subject for discussion at seminars and advisory group meetings.

E.152. Three co-ordinated research programmes will continue to concentrate on the technological and economic feasibility of the radiation preservation and sanitation of fruits, vegetables, grains and condiments, the preservation of fish and fishery products and the wholesomeness of irradiated food.

E.153. Special missions will be undertaken to advise Member States, on request, on organizing and conducting work on the irradiation of food and animal feed. Annual regional seminars on food irradiation are planned subject to the availability of funds. It is planned to hold advisory group meetings and consultants' meetings and to organize interregional training courses on food irradiation technology and techniques.

STRUCTURE

E.154. This sub-programme (with which six technical assistance projects are associated at present) consists of two components, which are described in the following paragraphs.

Food preservation

Summary by programme components

Table E. 10

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Technological and economic feasibility of food irradiation	2.4(0.1) ^{a/}	0.2(1.1)	128 000	21 000	59 000	4 000	212 000
Public health acceptance and regulatory aspects of the process of food irradiation	1.7(0.1)	0.2(1.0)	97 900	-	34 000	3 100	135 000
Linguistic services	-	-	-	-	-	14 000	14 000
Printing and publishing services	-	-	-	-	-	50 000	50 000
TOTAL	4.1(0.2)	0.4(2.1)	225 900	21 000	93 000	71 100	411 000

^{a/} FAO staff in brackets

Technological and economic feasibility of food irradiation

Objective

E. 155. The objective is to collaborate in the implementation of projects for extending the shelf life of important food items and in the pilot-scale irradiation of certain food products through the rigorous examination - with emphasis on competitiveness - of technological feasibility, economics and energy requirements (1974-84).

Results to date

E. 156. Technical feasibility studies involving small-scale and pilot-scale experiments have demonstrated the potential advantages of irradiation in processing a number of food items of considerable economic importance. One Member State has commercialized a food item (potatoes) irradiated on an industrial scale, and certain food items (fish, onions, mangoes) irradiated on a semi-industrial scale have been commercialized in a number of other Member States.

E. 157. The Asian Regional Project on Radiation Preservation of Fish and Fishery Products (RPF), formally established in 1975 as part of the Agency-initiated Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA)[E. 1], is being conducted on a small scale while financial support is sought from UNDP.

E. 158. Arrangements have been made for the establishment of an "International Facility for Food Irradiation Technology" (IFFIT), a co-operative venture of FAO, the Agency and the Government of the Netherlands (under an agreement establishing the Facility, the Agency will provide a project director, and for this purpose an additional Professional post (at the P-5 level) will be required; because of financial restrictions, this post will be provided for only in 1980).

[E. 1] Reproduced in document INFCIRC/167.

Plans for 1979-80

E.159. Pilot-scale feasibility studies (mainly on root crops, grains, fruits, vegetables and fishery products) will be conducted through IFFIT. Special attention will be paid to training scientists from developing countries in the technology and economics of food irradiation and in the commercialization of irradiated food items.

E.160. The economics and the energy-saving aspects of food irradiation will be reviewed in 1979 (Advisory Group - Annex II (76)). Progress in the use of irradiation in combination with other food preservation processes will be reviewed in 1980 (Symposium - Annex III (8)).

E.161. Studies of the technological and economic feasibility of food irradiation (Table E.11, No. 27) and work being done in national laboratories in Asia on the radiation preservation of fish and fishery products (Table E.11, No. 29) will continue to be co-ordinated.

Related activities

E.162. Technical assistance from the Agency's own resources and from UNDP resources will be sought for RPF.

E.163. Subject to the availability of funds, training courses on food irradiation technology will be held in 1979 and 1980. Services will be provided in support of technical assistance projects.

Plans for 1981-84

E.164. Emphasis will be placed on larger-scale pilot-plant experiments and on commercialization studies.

E.165. Collaboration with UNEP in studies of the environmental impact of food irradiation is envisaged.

Co-operation with other organizations

E.166. This programme component involves co-operation with UNEP, CEC and CMEA. Co-operation regarding both scientific and public acceptance questions with international scientific bodies such as ESNA, the International Union of Food Science and Technology and IUPAC is also envisaged.

Public health acceptance and regulatory aspects of the process of food irradiation

Objective

E.167. The objective is to assist in achieving general acceptance of the food irradiation process as a means of reducing world food losses.

Results to date

E.168. Large-scale, long-term wholesomeness experiments, some performed as part of the International Project in the Field of Food Irradiation (IFIP), the host institute for which is at the Nuclear Research Centre in Karlsruhe, Federal Republic of Germany, and in which 24 countries are participating, have failed to demonstrate any harmful effects of the consumption of irradiated food. So far, 26 food items have been given limited or unlimited public health clearance in 19 countries.

Plans for 1979-80

E.169. Participation in IFIP will continue under the present agreement, which runs until 1981. In 1980, a joint FAO/IAEA/WHO expert committee (Advisory Group) will review wholesomeness data with a view to recommending international acceptance of the irradiation

of broad groups of foods of similar chemical composition and/or of all foods irradiated below a certain dose level (for example, 1 Mrad) - or even of the food irradiation process as such. In this connection, studies of the radiolysis of food components and complex foods will be intensified.

E.170. Collaboration with WHO, with the Codex Alimentarius Commission of the FAO/WHO Food Standards Programme and with appropriate bodies within CEC and CMEA is foreseen, the aim being to achieve international agreement on the wholesomeness of irradiated foods and the acceptability of the food irradiation process.

E.171. Research in national laboratories on the wholesomeness of irradiated foods will continue to be co-ordinated (Table E. 11, No. 28) with a research co-ordination meeting planned for 1980.

E.172. Work concerning regulatory aspects of food irradiation will be carried out in co-operation with the Agency's Legal Division.

Related activities

E.173. Support services will be provided for technical assistance projects.

Plans for 1981-84

E.174. Activities will centre on achieving global acceptance of the food irradiation process.

Co-operation with other organizations

E.175. Co-operation with WHO, NEA and the Codex Alimentarius Commission of the FAO/WHO Food Standards Programme is an important part of this programme component.

Co-ordinated research programmes

Table E. 11

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
1. Use of isotopes in fertilizer efficiency studies on grain legumes	4	3	1972	1978
2. Use of radiation and isotope techniques in studies of soil-water regimes	6	5	1972	1978
3. Isotope-aided micronutrient studies in rice production with special reference to zinc deficiencies	8	2	1973	1980
4. Isotope techniques in studies of biological nitrogen fixation for the dual purpose of increasing crop production and decreasing nitrogen fertilizer use	-	1	1977	1982
5. Isotope and radiation techniques for efficient water and fertilizer use in semi-arid regions	This programme has been approved but no contract has yet been awarded.			
6. Use of isotopes in pest management	This programme has been approved but no contract has yet been awarded.			
7. Tsetse fly control or eradication by the sterile-male technique	2	7	1970	1979
8. Agricultural nitrogen residues with particular reference to their conservation as fertilizers and behaviour as potential pollutants	15	5	1974	1980
9. Isotopic-tracer-aided studies of chemical residues in cotton seed, feed, oil and related products	8	1	1974	1978

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
10. Isotopic-tracer-aided research and monitoring programme on agricultural residue-biological interactions in aquatic eco-systems	3	4	1976	1981
11. Isotopic-tracer-aided studies of agrochemical residue-soil biota interactions	3	1	1977	1982
12. Isotopic-tracer-aided studies of atmospheric sulphur pollutant-plant interactions	This programme has been approved but no contract has yet been awarded.			
13. Use of nuclear techniques for seed protein improvement	15	9	1971	1978
14. Use of induced mutations for disease resistance in crop plants	10	8	1970	1978
15. Use of induced mutations in rice breeding and production	-	6	1972	1978
16. Improvement of mutation breeding techniques	-	10	1972	1978
17. Improvement of vegetatively propagated crops and tree crops through radiation-induced mutations	8	8	1972	1979
18. Use of aneuploids for wheat protein improvement	6	6	1975	1978
19. Use of radiation-induced and chemically induced mutations to provide an improved germ plasma base for grain legume production in South East Asia	6	-	1976	1981
20. Radiation-induced semi-dwarf rice mutant stocks	This programme has been approved but no contract has yet been awarded.			
21. Induced mutations for disease resistance in grain legumes	This programme has been approved but no contract has yet been awarded.			
22. Water requirements of tropical herbivores	8	5	1974	1980

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
23. Use of radioisotope and related techniques to improve domestic buffalo production	This programme has been approved but no contract has yet been awarded.			
24. Use of radioimmunoassay and related techniques to improve the reproductive performance of domestic animals	12	5	1976	1981
25. Use of isotopes to detect moderate mineral imbalances in farm animals	8	5	1976	1981
26. Use of isotope techniques in studying and controlling ticks and tick-borne diseases	This programme has been approved but no contract has yet been awarded.			
27. Technological and economic feasibility of food irradiation	8	7	1974	1979
28. Wholesomeness of the process of food irradiation	8	2	1974	1979
29. Radiation preservation of Asian fish and fishery products	5	1	1974	1979

F. LIFE SCIENCES

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table F. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	625 859	697 000	42 000	(29 000)	13 000	710 000	847 000
Consultants	22 478	50 000	2 700	(12 000)	(9 300)	40 700	54 500
Overtime	34	500	-	(500)	(500)	-	-
Temporary assistance	-	2 000	100	(100)	-	2 000	2 100
Sub-total	648 371	749 500	44 800	(41 600)	3 200	752 700	903 600
Common staff costs	172 942	202 400	4 200	(8 000)	(3 800)	198 600	232 700
Travel	18 071	33 000	2 300	(6 000)	(3 700)	29 300	43 000
Meetings							
Conferences, symposia, seminars	56 906	73 000	2 000	(31 000)	(29 000)	44 000	70 000
Technical committees, advisory groups	38 132	53 000	3 000	13 000	16 000	69 000	68 000
Representation and hospitality	2 962	5 600	200	(1 900)	(1 700)	3 900	5 000
Scientific and technical contracts	376 516	466 000	23 000	(24 000)	(1 000)	465 000	544 000
Scientific supplies and equipment	453	-	-	1 300	1 300	1 300	1 300
Common services, supplies and equipment	1 548	2 500	200	1 500	1 700	4 200	4 400
Transfer of costs:							
Linguistic services	71 543	44 000	2 500	(1 500)	1 000	45 000	75 000
Printing and publishing services	193 295	246 000	6 000	(155 000)	(149 000)	97 000	290 000
Data processing services	7 299	28 000	500	1 500	2 000	30 000	35 000
Laboratory services	448 450	356 000	18 000	214 000	232 000	588 000	785 000
TOTAL	2 036 488	2 259 000	106 700	(37 700)	69 000	2 328 000	3 057 000

SUMMARY OF MANPOWER

Table F. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
D	1	1	1	-	1	1
P-5	5	5	5	-	5	5
P-4	7	7	7	-	7	8
P-3	1	1	1	-	1	1
P-2	1	1	1	-	1	1
Sub-total	15	15	15	-	15	16
GS	10	10	10	-	10	11
TOTAL	25	25	25	-	25	27

CHANGES IN COSTS AND MANPOWER

Costs

F. 1. As will be seen from Table F. 1 above, it is expected that the cost of this programme will increase by \$69 000 as a net result of salary and other price increases of \$106 700 partly offset by a programme decrease of \$37 700.

F. 2. The programme decrease of \$37 000 in respect of salaries for established posts and common staff costs reflects the intention to delay the recruitment of new staff to replace departing staff members. Further programme decreases are foreseen in respect of consultants' services (\$12 000), overtime and temporary assistance (\$600) and duty travel (\$6000).

F. 3. The programme reduction of \$31 000 in respect of symposia and seminars is attributable to the fact that for 1979 one symposium and one seminar are planned, while the 1978 budget provided for two symposia, and that no interpretation will be provided for the seminar. It is planned to convene six technical committees and advisory groups in 1979 compared with the five which were foreseen in the 1978 budget; the programme increase of \$13 000 is attributable to the additional meeting. A programme reduction of \$1900 will be possible in respect of hospitality.

F. 4. A programme decrease of \$24 000 is planned in respect of scientific and technical contracts, mainly in the "Medical applications" and the "Radiation biology" sub-programmes. The "Health-related environmental research" sub-programme will require a programme increase of \$1300 for scientific supplies and equipment, and the "Dosimetry for intentional radiation exposures" sub-programme will require an additional \$1500 under common services, supplies and equipment for carrying out dose comparison services.

F. 5. As regards service costs, programme decreases are foreseen in respect of linguistic services (\$1500) and printing and publishing services (\$155 000). A programme increase of \$1500 is foreseen in respect of data processing services. The increase of \$214 000 in respect of laboratory services is attributable to the move to a new laboratory wing at Seibersdorf.

F. 6. The Government of the United States of America is continuing to support activities under the "Instrumentation requirements for nuclear medicine in developing countries" component, with a special contribution of \$10 000 in 1979.

Manpower

F. 7. No additional manpower is foreseen for 1979.

F. 8. For 1980, the addition of one Professional post (at the P-4 level) for the "Medical applications" sub-programme and of one GS post for the Dosimetry Laboratory (in support of the Agency's dose intercomparison programme) is foreseen.

THE PROGRAMME

OBJECTIVE

F. 9. The objective is to foster - in close collaboration with other organizations belonging to the United Nations family, especially WHO, to whom it is the Agency's policy to hand over at the appropriate time those activities in the programme which relate to procedures whose applications have become routine - the development of techniques for the application of radiation and radionuclides in medicine, biology and health-related environmental research and to promote the use of techniques for improving accuracy in radiation dosimetry.

STRUCTURE

F. 10. This programme consists of four sub-programmes, which are dealt with separately below.

Summary of manpower and costs by sub-programme

Table F. 3

Sub-programme	1979 Estimate			1980 Preliminary estimate		
	Man-years		Costs	Man-years		Costs
	P	GS		P	GS	
Medical applications	3.2	2.2	1 064 000	4.2	2.2	1 231 000
Dosimetry for intentional radiation exposures	4.3	4.3	522 000	4.3	5.3	859 000
Radiation biology	4.3	2.3	450 000	4.3	2.3	544 000
Health-related environmental research	3.2	1.2	292 000	3.2	1.2	423 000
TOTAL	15.0	10.0	2 328 000	16.0	11.0	3 057 000

SUB - PROGRAMMES

Medical applications

OBJECTIVE

F. 11. The objective is to provide advice and assistance to Member States, particularly developing countries, in acquiring techniques appropriate to the use of radionuclides in preventive and clinical medicine and in medical research and, in collaboration with WHO, to guide their introduction into applications of local importance.

PLANS FOR 1979-84

F. 12. This sub-programme will involve the same activities as in the period 1977-78, all aimed at making available in developing countries the instruments and methodology required for the successful application of radioisotopes to health problems of local importance. Emphasis will be placed on encouraging improvements in rather than on increasing the number of radionuclide applications and special efforts will be made to provide integrated support to the Agency's technical assistance programme.

STRUCTURE

F. 13. This sub-programme consists of four components, which are described in the following paragraphs.

Medical applications

Summary by programme components

Table F. 4

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Instrumentation requirements for nuclear medicine in developing countries	0.7	0.7	55 000	10 000	65 000	4 000	134 000
Technical improvement of in vitro assay procedures with radioactive agents	1.0	0.5	73 500	-	65 000	2 500	141 000
Technical improvement of in vivo procedures with radioactive agents	1.0	0.6	74 900	10 000	27 000	2 100	114 000
Activation analysis of elements of biological significance	0.5	0.4	39 800	-	38 000	2 200	80 000
Linguistic services	-	-	-	-	-	14 000	14 000
Printing and publishing services	-	-	-	-	-	57 000	57 000
Data processing services	-	-	-	-	-	14 000	14 000
Laboratory services	-	-	-	-	-	510 000	510 000
TOTAL	3.2	2.2	243 200	20 000	195 000	605 800	1 064 000

Instrument requirements for nuclear medicine in developing countries

Objective

F. 14. The objective is to stimulate more effective utilization of nuclear medicine instruments in developing countries by: (a) encouraging comparisons by laboratories in developing countries of the value of alternative nuclear medicine procedures (1979-81), using the methodology of cost-effectiveness analysis developed in pilot studies in 1976-78; (b) formulating recommendations on and arranging for the construction of prototype instruments for the application of such procedures under the conditions found in developing countries (1976-81); and (c) helping to devise improved strategies for instrument maintenance (1976-79).

Results to date

F. 15. This component has since 1975 been receiving encouragement and supplementary financial support from the Government of the United States of America.

F. 16. A research contract was concluded in 1976 for the establishment and testing of a methodology for the cost-effectiveness analysis of alternative medical applications of radionuclides in developing countries. With the aid of consultants, several nuclear medicine instrument systems have been explored to identify attributes of special importance for their effective use in developing countries; a prototype automatic well scintillation counter for use in developing countries has been designed and assembled in the Agency's Laboratory.

F. 17. An advisory group on the maintenance of nuclear medicine instruments in developing countries met in 1975; a maintenance survey covering about 150 laboratories in South East Asia was carried out in 1977 and preparations have been made for further surveys in other regions (Table F. 8, No. 5).

F. 18. Since 1975 staff members have participated in teaching at or the organization of three training courses on nuclear electronics. During the period 1972-77, most of the approximately 80 Agency-financed technical assistance projects concerning medical applications of radionuclides involved the purchase of nuclear medicine instruments, in whose selection technical advice was provided under this component.

Plans for 1979-80

F. 19. The cost-effectiveness analysis methodology mentioned above will be tested further, under a new co-ordinated research programme, if possible with emphasis on local situations in developing countries; it is expected that additional information regarding the value of the methodology will be obtained from participants in Agency technical assistance missions. The merits of the methodology will be reviewed in 1980 (Advisory Group).

F. 20. Through established contacts with instrument designers, manufacturers and users, the design, production and field-testing of instruments suitable for nuclear medicine applications in developing countries will be further encouraged in the light of the results of instrument system surveys carried out in 1977-78.

F. 21. The maintenance surveys will be completed in 1979 and the results reviewed in the same year (Advisory Group - Annex II (77)); subsequently, support will be given for the implementation of whatever strategies for improving instrument maintenance it has proved possible to identify.

Related activities

F. 22. All activities under the "Nuclear medicine" sub-programme will benefit from the results of the work done under this component, as will most of the technical assistance projects involving medical applications of radioisotopes. Agency-sponsored training courses in nuclear instrumentation will continue to be supported. The development, testing and intercomparison of instruments in the Agency's Laboratory will continue.

Plans for 1981-84

F. 23. It is foreseen that many of the activities initiated before 1981 will continue into the period 1981-84. Further efforts to identify worthwhile applications of radionuclides, especially on the part of workers in developing countries, will be required; the manner in which the Agency can render assistance most usefully should emerge from research results and from the reports of participants in technical assistance missions. Rapid progress in the development of nuclear medicine instruments will create new problems but also new opportunities for the supply of instruments capable of giving effective service in developing countries. It is hoped that opportunities for introducing better maintenance strategies will have been revealed in the surveys already conducted and that support can be given for their introduction.

Co-operation with other organizations

F. 24. Close collaboration with WHO will be maintained, especially with regard to identifying worthwhile applications of radionuclides and to supporting instrument maintenance in the field. Contact will also be maintained with other United Nations organizations engaged in activities relating to instrument maintenance.

Technical improvement of in vitro assay procedures with radioactive agents

Objective

F. 25. The objective is to intercompare and to test the effectiveness of selected procedures for the in vitro assay of biologically active substances and, in collaboration with WHO, to guide their application to the solution of health problems, especially those of importance in developing countries, in particular by: (a) examining the suitability and reliability of assay reagents and kits, especially for thyroid studies, and testing the effectiveness of in vitro techniques in dealing with particular health problems in tropical regions (1978-82); and (b) completing the co-ordinated testing, in several laboratories, of simple automatic sample counters for in vitro assay work (1979).

Results to date

F. 26. Under this component, which was initiated in 1969, technical support has been provided for the Agency's technical assistance programme; of the approximately 80 technical assistance projects relating to medical applications of radioisotopes for which experts and/or equipment were provided from the Agency's own resources during the period 1972-77, about one third were concerned largely with in vitro assay procedures.

F. 27. A co-ordinated research programme on radioisotope technique applications in immunological studies of communicable diseases, organized in response to a WHO initiative and completed in 1975, demonstrated the possibility of determining immunological status by means of radioisotope techniques, although specificity remains a problem as with other techniques. A further co-ordinated research programme on general in vitro assay techniques is due to be completed this year (Table F. 8, No. 1) and one on in vitro assay procedures for reproductive physiology studies in 1979 (Table F. 8, No. 2). Plans have been made for one on in vitro assay procedures for thyroid studies to start this year (the distribution of reagents to research groups in developing countries wishing to adapt in vitro assay procedures for use under local conditions is envisaged).

F. 28. A panel meeting on radioactive tracers in microbial immunology was held in 1971 and one on the standardization of radioimmunoassay procedures in 1972. An advisory group on the facilities needed for in vitro assays, particularly in developing countries, was convened in 1977, and plans have been made for one to give guidance this year on the development of the Agency's research programme under this component.

F. 29. Training courses on radioimmunoassay techniques were held in 1971, 1974 and 1975. Symposia on radioimmunoassay and related procedures in medicine were held in 1969, 1973 and 1977.

Plans for 1979-80

F. 30. The co-ordinated research programme on in vitro assay procedures for thyroid studies will continue during this period. A further one, dealing with in vitro assay procedures for the study of a particular health problem in tropical regions, will be initiated in 1979. Increased attention will be paid in this and other co-ordinated research programmes to assay quality control. Guidance on the further development of this component in the light of advances in in vitro assay techniques in general will be formulated in 1980 (Advisory Group). A further training course on radioimmunoassay techniques is planned for 1979.

Related activities

F. 31. Support for Agency technical assistance projects is expected to continue at the present level. The work done under this component is in turn supported by the Medical Applications Section of the Agency's Laboratory.

Plans for 1981-84

F. 32. The co-ordinated research programme on in vitro assay procedures for thyroid studies and that on procedures for the study of a particular health problem in tropical regions are likely to be completed before the end of this period. An advisory group will again be convened to give guidance on the further development of the component. Further training courses will be held. A further symposium in the series on radioimmunoassay and related procedures in medicine will be proposed for 1981.

Co-operation with other organizations

F. 33. Close co-operation with WHO will continue.

Technical improvement of in vivo procedures with radioactive agents

Objective

F. 34. The objective is to intercompare and to test the effectiveness of selected in vivo procedures for clinical diagnosis and research and, in collaboration with WHO, to guide their application to the solution of health problems of importance in developing countries, in particular by: (a) further developing various techniques appropriate to the study of gastrointestinal malabsorption (1976-79); and (b) comparing techniques for the study of kidney function (1977-79).

Results to date

F. 35. Of the approximately 80 technical assistance projects relating to medical applications of radioisotopes for which experts and/or equipment were provided from the Agency's own resources during the period 1972-77, about two thirds were concerned at least in part with in vivo assay procedures.

F. 36. A symposium on dynamic studies with radioisotopes in medicine was held in 1974 and symposia on medical radionuclide imaging in 1972 and 1976. Seminars and expert committee meetings on the training of radioisotope technicians (1971), of medical physicists (1972) and of nuclear medicine physicians (1974) have been organized jointly with WHO. Meetings of various types have been held on the use of radioisotopes in haematology (1973, 1977), on the use of radionuclide techniques in studying gastrointestinal absorption (1973, 1976) and in kidney function studies (1977) and on computer-assisted scintigraphy (1973-77).

F. 37. An Agency/WHO programme on iron nutrition and a co-ordinated research programme on computer-assisted scintigraphy were completed in 1975 and 1976 respectively.

Plans for 1979-80

F. 38. An envisaged Agency/WHO co-ordinated research programme on the study of gastrointestinal malabsorption would be completed during this period, as will efforts to compare and improve radionuclide techniques for kidney function studies; the latter activity may lead to new emphasis on the quality control of in vivo radionuclide procedures and to support for the introduction of effective quality control at laboratories in developing countries. In 1979, ways in which quality control studies relating to specific procedures have been conducted in different countries (for example, through nationally sponsored workshops) will be reviewed and recommendations will be made on how the Agency might encourage national quality control programmes (Advisory Group - Annex II (78)).

F. 39. The latest advances in medical radionuclide imaging will be reviewed in 1980 (Symposium - Annex III (9)). A training course will be proposed for 1980 as a means of introducing quality control in the field of radionuclide imaging; it may be followed by similar training courses under local sponsorship.

Related activities

F. 40. Support for Agency technical assistance projects is expected to continue at the present level, particularly in the evaluation of requests for experts, equipment and fellowships. The work done under this component is in turn supported by the Medical Applications Section of the Agency's Laboratory. The Laboratory's programme for monitoring the contamination of Agency staff by plutonium and other radionuclides is also related to this component.

Plans for 1981-84

F. 41. Activities in support of technical assistance will continue to play a central part in this component, the future of which will depend to a considerable extent on the results of work done under the component "Instrument requirements for nuclear medicine in developing countries". It is expected that efforts to strengthen quality control procedures in individual laboratories engaged in in vivo radionuclide applications will be increased.

Co-operation with other organizations

F. 42. This component will continue to be implemented with the advice and co-operation of WHO. Contact with the International Committee for Standardization in Haematology will also be maintained.

Activation analysis of elements of biological significance

Objective

F. 43. The objective is to intercompare and to assist in improving nuclear activation analysis techniques (especially those involving the use of research reactors) for the assay of trace elements of biomedical significance and, in collaboration with WHO, to guide their application to the solution of health problems distinctively associated with local environments, in particular by: (a) conducting studies of trace elements in foods, especially human milk (1976-80); (b) studying selected problems in occupational health (1978-82); and (c) preparing analytical quality control samples relevant to the assay of trace elements in biological materials, especially animal muscle and bone (1976-80).

Results to date

F. 44. In connection with this component, which was established in 1965, a total of 19 research contracts and research agreements have been concluded.

F. 45. From 1971 to this year the main activity has been an Agency/WHO co-ordinated programme of research in the medical applications of activation analysis, with emphasis on trace elements in cardiovascular diseases (Table F.8, No. 3); meetings of investigators were held in 1971, 1973, 1974 and 1977, and the reports of these meetings have been published. A co-ordinated research programme on trace elements in human nutrition (Table F.8, No. 4), also organized in collaboration with WHO, started in 1976 and a research co-ordination meeting was held in 1977. Support for both programmes has been provided by the Laboratory, particularly in the field of analytical quality control.

F. 46. Work at the Laboratory has resulted in the development of several new analytical reference materials, which have become widely used; other activities have yielded results relating to cystic fibrosis, goitre and cancer. In collaboration with the Laboratory's Metrology Section, a reference service to assist in the evaluation of Ge(Li) gamma-ray spectra has been developed.

F. 47. An advisory group on comparative methods for the study of trace elements in biological materials met in 1976 (its report is being published this year). A technical

committee on stable isotopes in the life sciences met in 1977 and the proceedings have been published. Plans have been made for a symposium on nuclear activation techniques in the life sciences to be held this year.

Plans for 1979-80

F. 48. The Agency/WHO co-ordinated programme of research in medical applications of activation analysis will have been completed before the start of this period; however, final data evaluation and preparation of the report will take place in 1979. The Agency/WHO co-ordinated research programme on trace elements in human nutrition will reach its final phase in 1980.

F. 49. A new co-ordinated research programme, on trace elements in occupational health, will reach a peak during this period. The initiation of a programme on the application of stable isotope tracers is planned. Work relating to all these programmes will be guided by outside experts, the final aim being the preparation of manuals.

F. 50. Progress in in vivo activation analysis as applied in medical diagnostics and in occupational health studies will be reviewed in 1980 (Advisory Group). Work on the preparation of animal muscle and bone samples for analytical quality control purposes will be completed in 1980.

Related activities

F. 51. Close co-operation will be maintained with other units within the Agency which have an interest in activation analysis and stable isotopes, and advice and assistance will be provided where appropriate. Continued support will be provided for the analytical quality control activities of the Agency's Laboratory.

Plans for 1981-84

F. 52. It is expected that the envisaged co-ordinated research programme on trace elements in occupational health would be completed during this period. Work in other areas (such as stable isotope studies) and on other diseases (such as malnutrition and cancer) may then be intensified.

Co-operation with other organizations

F. 53. Close collaboration will be maintained with WHO, particularly in respect of those research activities which have been formally established as joint Agency/WHO programmes. Contact will be established with other organizations, such as FAO and UNEP, where appropriate.

Dosimetry for intentional radiation exposures

OBJECTIVE

F. 54. The objective is to advise Member States on the application of techniques for ionizing radiation dosimetry and to provide assistance and services and make recommendations aimed at improving dosimetric accuracy in biomedical and industrial radiation applications.

PLANS FOR 1979-84

F. 55. Under the component entitled "Network of Secondary Standards Dosimetry Laboratories (SSDL Network)", which has become the central component of this sub-programme, WHO will continue to have the main responsibility for the secretariat of the

Network and the Agency will assist in the setting up of SSDLs, co-ordinate their activities, organize dose intercomparisons between SSDLs on one hand and the Agency's Dosimetry Laboratory on the other and support the training of SSDL staff.

F. 56. In view of the increasing demand for higher dosimetry accuracy in radiotherapy, the Agency/WHO postal dose intercomparison service for X-rays and cobalt-60 gamma radiation will continue for those countries where SSDL services are not yet available.

F. 57. Within the framework of the new component "Dosimetry for industrial radiation processing", dose intercomparisons will be organized for food irradiation and medical product sterilization facilities in Member States.

F. 58. It is expected that the Dosimetry Laboratory will participate in a further inter-comparison exercise under the European Neutron Dose Intercomparison Programme (ENDIP). Physical aspects of biomedical dosimetry (including instrumentation and calibration questions) will be reviewed in 1980 (Symposium - Annex III (11)).

STRUCTURE

F. 59. This sub-programme consists of four components, which are described in the following paragraphs.

Dosimetry for intentional radiation exposures

Summary by programme components

Table F. 5

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Network of Secondary Standards Dosimetry Laboratories (SSDL Network)	1.4	0.6	88 600	-	9 000	4 400	102 000
Dose intercomparison services	1.0	1.6	74 900	12 000	16 000	4 100	107 000
Dose intercomparison development	0.8	1.5	66 000		20 000	2 000	88 000
Dosimetry for industrial radiation processing	1.1	0.6	71 500	-	34 000	1 500	107 000
Linguistic services	-	-	-	-	-	12 000	12 000
Printing and publishing services	-	-	-	-	-	19 000	19 000
Data processing services	-	-	-	-	-	9 000	9 000
Laboratory services	-	-	-	-	-	78 000	78 000
TOTAL	4.3	4.3	301 000	12 000	79 000	130 000	522 000

Network of Secondary Standards Dosimetry Laboratories (SSDL Network)

Objective

F. 60. The objective is to assist, together with WHO and a number of collaborating institutions and affiliated members of the SSDL Network, in completing current work on the establishment of SSDLs and in setting up further SSDLs in Member States, mainly through the organization of dose intercomparisons involving member laboratories and the Agency's Dosimetry Laboratory, the creation of the necessary links between SSDLs and the primary metrology system, the supply of technical information and the provision of staff training (1985).

Results to date

F. 61. During 1977, the number of member laboratories increased from 9 to 27.

F. 62. Special dose intercomparisons involving the Agency's Dosimetry Laboratory and SSDLs in India, Bulgaria, Romania, Chile and Bolivia have been performed. Two SSDLs (in India and Brazil) are providing a regular national dose intercomparison service in co-operation with the Agency's Dosimetry Laboratory. A manual with guidance on instrumentation and calibration procedures at SSDLs has been published in the Agency's Technical Reports Series.

F. 63. There is evidence that the SSDL Network has become internationally recognized as an essential part of the international metrology system.

Plans for 1979-80

F. 64. It is expected that by 1980 the SSDL Network will comprise about 40 member laboratories, the majority in an early stage of development.

F. 65. Dose intercomparisons involving SSDLs and the Agency's Dosimetry Laboratory will be organized in order to check accuracy and precision and to impart confidence to staff doing calibration work. The results of such intercomparisons will be evaluated and incorporated into recommendations on work to be performed at SSDLs.

F. 66. All activities concerned with the SSDL Network will continue to be guided by the IAEA/WHO SSDL Advisory Group and executed with assistance and support from affiliated members of the Network.

Related activities

F. 67. Requests for technical assistance and research contracts in connection with the organization of local dose intercomparisons will be evaluated, training courses for SSDL staff will be organized and SSDL staff will be trained and dose intercomparisons performed at the Agency's Dosimetry Laboratory.

Plans for 1981-84

F. 68. It is expected that further laboratories will apply for membership of the SSDL Network. Activities aimed at integrating member laboratories into the international metrology system will continue.

Co-operation with other organizations

F. 69. The SSDL Network, which is a joint Agency/WHO venture, has seven affiliated members (the national standards laboratories of France, the United States, the United

Kingdom, Canada, Hungary, the Federal Republic of Germany and the Netherlands) and collaborates with the International Bureau of Weights and Measures, ICRU, the International Electrotechnical Commission and the International Organization of Legal Metrology.

Dose intercomparison services

Objective

F. 70. The objective is to conduct, jointly with WHO, dose intercomparisons aimed at improving the accuracy and reliability of absorbed dose measurements in radiotherapy and to organize calibration intercomparisons for member laboratories of the SSDL Network under the IAEA/WHO SSDL Working Arrangement (1968-85).

Results to date

F. 71. Since 1972, about 850 dose intercomparisons have been performed in 70 Member States; this number includes 45 intercomparisons for orthovoltage X-rays and 10 for high-energy radiation. A statistical evaluation of the results of 417 intercomparisons for cobalt-60 gamma radiation has been published in the scientific literature.

F. 72. In 1977, about 18% of the participating institutes had deviations of more than 10% in their dose determinations; most of the institutes with inaccurate dosimetry showed a considerable improvement in a subsequent intercomparison.

F. 73. The Dosimetry Laboratory participated in a first intercomparison of secondary standard dosimeters organized by the Agency in 1977 for a selected group of SSDLs.

F. 74. At a symposium on national and international standards of dosimetry held in 1977, recent developments in primary and secondary dosimetry instrumentation were reported and problems associated with the calibration chain extending from the primary laboratory via the secondary laboratory to the user were discussed, particularly in the light of the new SI system of units.

Plans for 1979-80

F. 75. Recommendations on suitable dose intercomparison systems for high-energy photon and electron radiation produced by accelerators will be formulated in 1979 (Advisory Group - Annex II (79)).

F. 76. The cobalt-60 gamma radiation dose intercomparison service will continue, with about 240 intercomparisons a year. It is expected that in a number of countries such intercomparisons will be performed by local SSDLs.

F. 77. It is expected that about 150 dose intercomparisons a year will be performed for orthovoltage X-rays and about 50 a year for high-energy radiation. The participants will be mainly laboratories in developing countries. The results will be evaluated with the help of consultants.

F. 78. Calibration intercomparisons involving selected member laboratories of the SSDL Network will continue at a rate of one or two a year.

Related activities

F. 79. The work done under this component is closely related to the activities of the SSDL Network and to the activities comprising the "Dose intercomparison development" component.

Plans for 1981-84

F. 80. It is expected that part of the cobalt-60 gamma radiation and orthovoltage X-ray dose intercomparison work will have been taken over by individual secondary standards dosimetry laboratories and that calibration intercomparisons will continue to be performed. High-energy X-ray dose intercomparisons may come to constitute a considerable part of the work done under this component.

Co-operation with other organizations

F. 81. Close co-operation with the International Bureau of Weights and Measures and with a number of primary standards laboratories for regular calibration of the Agency's secondary standard dosimeter has been established.

Dose intercomparison development

Objective

F. 82. The objective is to develop and test in the Dosimetry Laboratory new dosimetry instrumentation and procedures suitable for the cobalt-60 gamma and X-ray dose intercomparisons (1977-80), for dose intercomparisons in the high-dose range (radiation processing) (1977-84) and for mixed fast-neutron/gamma fields (1977-84).

Results to date

F. 83. An external-filter technique for orthovoltage X-ray dose intercomparisons has been developed in the Agency's Dosimetry Laboratory; it permits the determination both of absorbed dose and of radiation quality, and it has been successfully tested in a trial intercomparison involving 15 laboratories. The recommendations of an advisory group and the evaluated results of the trial intercomparison are being published in the Agency's Technical Reports Series.

F. 84. Work on the development of a transfer instrument for neutron dose intercomparisons which is being done under a co-ordinated research programme (Table F. 8, No. 6) has reached an advanced stage and results have been published in the scientific literature.

F. 85. A co-ordinated research programme on reactor in-pile dosimeter intercomparison and standardization was concluded in 1977 with a review of the intercomparison measurements performed in four different reactors. The results of the intercomparison were presented at the 7th annual meeting of the International Working Group on Reactor Radiation Measurements and show that the discrepancies found earlier can be avoided by employing standardized procedures during irradiation.

Plans for 1979-80

F. 86. With the help of consultants, the replacement of the time-consuming read-out procedure employed by Dosimetry Laboratory staff involved in the cobalt-60 gamma radiation and X-ray dose intercomparisons by automated methods (with a consequent reduction of their routine work load) will be completed.

F. 87. Some laboratory work will be required for the development of methods suitable for high-dose intercomparisons.

F. 88. Further participation of the Dosimetry Laboratory in the European Neutron Dose Intercomparison Programme (ENDIP) is envisaged.

Plans for 1981-84

F. 89. It is expected that the development of instrumentation for high-dose and X-ray dose intercomparisons will be completed. However, some work on specific dosimetry problems relating to the development of fusion test reactors may become necessary. Work on instrumentation and procedures for mixed fast-neutron/gamma fields will continue.

Co-operation with other organizations

F. 90. Close co-operation will be maintained with the Hungarian National Office of Measures.

Dosimetry for industrial radiation processing

Objective

F. 91. The objective is to assist in improving dosimetric reliability and accuracy in the high-dose range by achieving standardization of dosimetry methods and procedures at the international level (1982) and by organizing dose intercomparisons.

Results to date

F. 92. Following a survey in which 62 institutes expressed the view that standardization in the field of high-dose measurements was necessary, a group of consultants meeting in 1977 identified areas where international efforts would be most desirable. The consultants recommended that the Agency organize a trial dose intercomparison using selected dosimetry systems; the intercomparison took place later in 1977 with nine participating institutes, and the results show that three of the five dosimetry systems used are well suited for high-dose intercomparisons on a larger scale.

F. 93. A publication entitled "Manual of Food Irradiation Dosimetry" was issued in the Agency's Technical Reports Series in 1977.

Plans for 1979-80

F. 94. The standardization of dosimetry methods and procedures for high doses and high-dose rates will be promoted with the help of consultants and in collaboration with the "Food preservation", "Radiation biology" and "Industrial applications and chemistry" sub-programmes. Dose intercomparisons for both photon and electron irradiators will be organized. The results of a high-dose intercomparison will be reviewed in 1980 (Advisory Group) and recommendations made regarding suitable dosimetry systems.

F. 95. A co-ordinated research programme aimed at the development of reliable dosimetry systems is envisaged and a training course on high-dose dosimetry will be organized.

F. 96. The publication of a world directory of high-dose irradiation facilities is planned. Some equipment necessary for the evaluation of dosimeters will be installed in the Dosimetry Laboratory.

Related activities

F. 97. Requests relating to technical assistance projects and to research contracts will continue to be evaluated.

Plans for 1981-84

F. 98. In view of the growing number of high-dose irradiation plants in service, high-dose intercomparison and training activities are expected to continue.

Co-operation with other organizations

F. 99. At present, the Agency's Dosimetry Laboratory is not equipped for performing dose intercomparisons in the high-dose and high-dose-rate ranges; such dose intercomparisons have therefore to be performed on a contract basis by a number of qualified national laboratories, co-operation with which is vital for this programme component.

Radiation biology

OBJECTIVE

F. 100. The objective is to advise and assist Member States, particularly developing countries, in connection with the application of the results of recent radiobiological research in producing medical supplies and pharmaceuticals, in the control of parasitic diseases, in cancer therapy, in the treatment of wastes and in the evaluation of hazards due to environmental pollutants.

PLANS FOR 1979-84

F. 101. Work will continue to be directed to the establishment of a sound basis and suitable methodologies for the application of radiobiological research results in the radiation sterilization of medical supplies and pharmaceuticals, to the radiation attenuation of parasites and other infective agents for use in the preparation of vaccines against human diseases, to the improvement of the radiation therapy of cancer through the use of radio-sensitivity modification and heavy particles, and to the radiation treatment of domestic and industrial wastes.

F. 102. Increased emphasis will be placed on the radiobiological studies needed for the development of test systems to facilitate an objective evaluation of the biological hazards of the low-level radiation associated with the utilization of nuclear energy as compared with the biological hazards due to major chemical pollutants released to the human environment from non-nuclear power generation facilities.

F. 103. Account will continue to be taken of the growing interest and needs of developing Member States, the aim being to introduce practices which are relevant to their local conditions and which will lead to improvements in their existing health care services.

STRUCTURE

F. 104. This sub-programme consists of five components, which are described in the following paragraphs.

Radiation biology

Summary by programme components

Table F. 6

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Radiation sterilization of medical supplies including pharmaceuticals	0.7	0.5	44 600	-	30 000	400	75 000
Vaccine preparation with the help of radiation	1.0	0.6	59 000	-	30 000	2 000	91 000
Application of recent radio-biological research results in radiotherapy	1.2	0.4	66 900	14 000	46 000	3 100	130 000
Radiation treatment of wastes	-	-	-	-	-	-	-
Biological hazards of low-level radiation as compared with chemical pollutants	1.4	0.8	54 700	42 000	40 000	3 300	140 000
Linguistic services	-	-	-	-	-	8 000	8 000
Printing and publishing services	-	-	-	-	-	6 000	6 000
TOTAL	4.3	2.3	225 200	56 000	146 000	22 800	450 000

Radiation sterilization of medical supplies including pharmaceuticals

Objective

F. 105. The objective is to determine optimum conditions for the sterilization of medical products, pharmaceuticals and transplantable and implantable materials, with emphasis on local conditions in Asian and African countries (1979-80).

Results to date

F. 106. During the period 1972-77, work centred on applications of radiation for the sterilization of hermetically sealed, ready-to-use medical supplies such as sutures, implants and certain transplants (including bone and nerve tissue grafts); progress has been reviewed at two research co-ordination meetings, at an advisory group meeting and at a symposium. The proceedings of the symposium and a manual on the radiation sterilization of medical and biological materials have been published.

F. 107. Research under a co-ordinated programme for countries in Europe was completed in 1976. In view of the growing interest of Member States in Asia and the Far East in improving their present health care services through the introduction of radiation sterilization practices suited to local environmental and other factors, a co-ordinated research programme involving the participation of institutes in nine countries (Australia, Bangladesh, Burma, India, Indonesia, the Republic of Korea, Pakistan, the Philippines and Thailand) was initiated in 1976 (Table F. 8, No. 10). Recommendations on practices and regulations for the radiation sterilization of medical products, made by groups of international experts, were published in 1975 in the proceedings of an Agency symposium held in Bombay in 1974; they have been used by many Member States in the formulation of their national codes of practice and regulations governing sterilization procedures and the control of the sterility of medical supplies.

F. 108. Biological monitoring systems using vegetative and spore-forming bacteria have been developed and made available to facilities in Argentina, Australia, Czechoslovakia, Denmark, Egypt, Greece, India, Japan and the Republic of Korea.

F. 109. About thirty-five fellowships and scientific visits relating to the radiation sterilization of medical products have been arranged under the Agency's technical assistance programme; in addition, the services of some ten experts have been made available.

Plans for 1979-80

F. 110. Research and development work on radiation sterilization practices suited to local conditions (especially conditions affecting microbial contamination) in Asian and African Member States will continue to be supported and co-ordinated, the emphasis shifting to determination of the optimum conditions for the radiation sterilization of pharmaceuticals. Radiation-induced alterations in the antigenic properties of biological tissue grafts intended for use in replacement and corrective surgery will be studied further.

Related activities

F. 111. Requests for fellowships and for the services of experts received from developing Member States interested in introducing the radiation sterilization of medical products will continue to be evaluated; advisory missions to such countries are also envisaged.

Plans for 1981-84

F. 112. In 1981, the institutes participating in the above-mentioned, ongoing co-ordinated research programme will meet to compare and consolidate their findings on optimum radiation sterilization practices. Possibilities of further co-ordinated research programmes for particular regions (for example, Latin America) will be considered in the light of regional needs.

F. 113. Subject to the availability of funds, seminars and training courses will be organized for countries in Asia and Africa.

F. 114. The recommendations on practices and regulations for the radiation sterilization of medical products will be reviewed and updated by groups of international experts, including representatives of national public health authorities and WHO, in the light of experience gained in the operation of commercial-scale irradiation facilities in both advanced and developing Member States.

Co-operation with other organizations

F. 115. Close co-operation is maintained with WHO in the development and standardization of radiation sterilization practices.

Vaccine preparation with the help of radiation

Objective

F. 116. The objective is to determine those diseases, especially diseases prevalent in developing countries, against which vaccines can advantageously be prepared with the help of radiation (1979/1980) and to explore the practical application of vaccines prepared in this way (1984).

Results to date

F. 117. This component was initiated in 1973 in the form of a co-ordinated research programme on the preparation of vaccines against parasitic diseases (Table F. 8, No. 7), organized in collaboration with the Agency's "Food and Agriculture" programme and WHO.

A panel meeting was held in 1973 and the proceedings published. Research co-ordination meetings were held in 1974 and 1976; following the 1976 meeting, a policy of promoting links between laboratories working on the same disease problem was initiated with a view to achieving a better exchange of information and techniques, particularly between laboratories in developing and advanced countries. Encouraging results which point to the development of effective vaccines against malaria, filariasis and schistosomiasis have been reported.

Plans for 1979-80

F. 118. Following a research co-ordination meeting this year at which the progress of the co-ordinated research programme is being reviewed and an examination in 1980 of problems associated with the use of radiovaccines in the immunological control of parasitic diseases (Advisory Group), diseases in respect of which nuclear techniques can advantageously be used in vaccine preparation will be identified.

Plans for 1981-84

F. 119. A new co-ordinated research programme will be directed at those diseases which present the greatest promise of control by immunological techniques and at the assessment of the comparative efficacies of irradiation and of chemical and other physical methods used in attenuation; emphasis will also be placed on the use of attenuated organisms and radioisotope tracers in the study of the processes involved in protective immunity. The progress of these activities will be reviewed in 1982.

Co-operation with other organizations

F. 120. Co-operation with the FAO/IAEA Joint Division and with WHO is foreseen.

Application of recent radiobiological research results in radiotherapy

Objective

F. 121. The objective is to promote and co-ordinate the study of ways of applying recent radiobiological research results in radiotherapy, with emphasis (1979-80) on radio-sensitivity modifiers and heavy particles.

Results to date

F. 122. At an advisory group meeting held in 1975 on modification of the radiosensitivity of biological systems, new types of radiosensitizer and radioprotector for use in cancer radiotherapy were discussed and evaluated. A review by a panel of experts revealed the need to establish a code of practice for evaluating the efficacy of such agents in clinical trials. A co-ordinated research programme on this subject was initiated in 1975 with the participation of institutes in developing and advanced Member States (Table F. 8, No. 8).

F. 123. The contribution of radiation biology to improvements in the radiotherapy of malignant diseases was reviewed in 1976 at a symposium attended by about 150 participants from 31 Member States and 3 international organizations.

F. 124. The possibility of using Auger emitters in cancer therapy has been explored at a consultants' meeting, where it became clear that a great deal of fundamental radiobiological research is necessary before any conclusions can be drawn regarding their practical value, and the initiation of a co-ordinated research programme (Table F. 8, No. 9) was proposed. Recent technological developments in generating high-LET radiation such as fast neutrons and pi-mesons for use in cancer therapy were reviewed by an advisory group in 1977; it was reported that high-LET radiation is being used successfully in clinics in a number of Member States, and the clinical and economic prospects for its use in cancer therapy were considered to be good.

F. 125. Ten fellowship applications and reports have been evaluated.

Plans for 1979-80

F. 126. The co-ordinated research programme on radiosensitivity modification will be concluded and evaluated during this period.

F. 127. It is planned to support, through research co-ordination, work on the biological effects of high-LET radiation from the point of view of its use in cancer therapy.

F. 128. The practical implications of recent radiobiological research concerning radiosensitivity modification and the use of high-LET radiation (including radiation emitted by californium-252 and radiation associated with neutron capture) will be reviewed in 1979 (Advisory Group - Annex II (81)) and recommendations made regarding the order of priorities to be adopted in the Agency's activities.

Related activities

F. 129. Depending on the availability of funds, a training seminar and other activities of a technical assistance nature will be organized.

Plans for 1981-84

F. 130. Studies will be supported on such techniques as radiosensitivity modification and the use of high-LET radiation and on other applications of recent radiobiological research which are of direct practical interest. As the use of such techniques becomes routine, they will be transferred to WHO.

Radiation treatment of wastes

Objective

F. 131. The objective is to determine optimum conditions for the radiation treatment of domestic and industrial wastes, with emphasis on biological aspects, and to formulate recommendations for the application of radiation technology in waste treatment (1976-84).

Results to date

F. 132. A technical committee meeting was held in 1977 to review the status of biological research relating to the use of ionizing radiation as a means of solving major industrial and municipal waste treatment problems, the prospects for which are improving, with the efficacy of irradiation in disinfecting and dewatering sewage sludge already established by pilot plant experience and with the number of pilot plants using different types of radiation source and treating waste of varied chemical, physical and biological composition increasing steadily. At the meeting it was concluded that the data on the radiosensitivity of pathogenic micro-organisms in waste were still inadequate and that intensified international collaboration was necessary in the compilation of data - especially data relating to disinfection doses, the influence of the medium, dose rates and radiation energy.

Plans for 1979-80

F. 133. In 1979, activities under this component will be temporarily suspended due to financial restrictions. In 1980, efforts will be made to promote international collaboration in the compilation of data on the radiosensitivity of pathogenic micro-organisms in waste.

Related activities

F. 134. In view of the increasing number of pilot- and industrial-scale plants for the radiation treatment of sewage and other waste, a study tour with visits to different plant types will be arranged for 1980 or 1981. Because of the multidisciplinary nature of the subject, co-ordination with various other scientific and technical activities of the Agency, such as those falling within the "Industrial applications and chemistry" sub-programme, will be intensified.

Plans for 1981-84

F. 135. A symposium to review the status of radiation technology for treating all types of waste will be proposed for 1981 or 1982 as a follow-up to the Agency symposium held in Munich in 1975.

F. 136. The emphasis will be shifted during this period towards techniques for improving the efficiency of radiation treatment (for example, the use of radiation in combination with heat).

Co-operation with other organizations

F. 137. This component involves co-operation with WHO, FAO and UNEP and co-ordination of activities with ESNA.

Biological hazards of low-level radiation as compared with chemical pollutants

Objective

F. 138. The objective is to develop a methodology for comparing biological hazards from radioactive and chemical pollutants, with emphasis on test systems (1977-84).

Results to date

F. 139. New methods and criteria for evaluating the biological effects of low-level radiation and for extrapolating results obtained with experimental animals to humans were discussed at a symposium in 1975.

F. 140. A co-ordinated research programme on the suitability of radiation-induced chromosomal aberrations as a monitor for use in estimating biological hazards (Table F. 8, No. 12) was initiated in 1975 with 12 participating countries; progress was reviewed at a research co-ordination meeting in 1977.

F. 141. A co-ordinated research programme was initiated in 1977 (Table F. 8, No. 11) in support of work on the comparative biological hazards from major chemical pollutants and low radiation doses.

F. 142. Also in 1977, an Agency-organized regional seminar on basic methods and techniques for use in radiobiological and health-related environmental research took place in Kenya.

F. 143. During the period 1972-77, 22 fellowship applications and reports relating to the development of chromosomal monitors of absorbed radiation dose were evaluated.

Plans for 1979-80

F. 144. Radiobiological and related genetic and cytogenetic studies necessary in developing a methodology and test systems for assessing the relative hazards of radioactive and chemical pollutants will continue under the co-ordinated research programme initiated in 1977.

F. 145. Work will continue on expressing chemical doses in terms of rem-equivalents for different chemical pollutant types; for this purpose, co-operation with WHO and UNEP will be established and Member States will be requested to make the services of experts available. Progress in this field will be reviewed at a research co-ordination meeting for those engaged in the co-ordinated research programme initiated in 1977 and at a meeting to be held in 1979 in conjunction with the 6th International Congress of Radiation Research.

F. 146. In the light of the interest shown by Member States, studies relating to the particular features of the biological effects of radionuclides released from nuclear facilities will be initiated and co-ordinated; the situation will be examined in 1979 (Symposium - Annex I (12)). Current information on the biological effects of radionuclides (especially tritium) released from present and future nuclear facilities will be reviewed in 1979 (Technical Committee - Annex II (80)).

Related activities

F. 147. Requests for training under the Agency's technical assistance programme will be evaluated and the training supervised.

Plans for 1981-84

F. 148. The methodology developed for assessing the biological effects of ionizing radiation and specific chemical pollutants will be refined for field application to a wider spectrum of environmental pollutants of interest to Member States. Progress will be reviewed periodically in the light of the possibility that new pollutants will be released to the environment as other nuclear technologies and alternative energy sources are developed.

F. 149. A symposium to consider the results of research into the genetic effects of low-level radiation will be proposed for 1981.

Co-operation with other organizations

F. 150. This component will continue to involve close co-operation with UNEP and WHO.

Health-related environmental research

OBJECTIVE

F. 151. The objective is to stimulate and co-ordinate national activities concerned with applications of nuclear methods for assessing the contamination of man by environmental pollutants and to compile and disseminate data on the pollution burden imposed on man by nuclear and non-nuclear power generation.

PLANS FOR 1979-84

F. 152. Work will be directed at contributing - with the help of nuclear methods - to studies of the non-radioactive contaminants of man, particularly in relation to his radioactive contamination.

F. 153. Work on the determination of trace element contaminants in human hair has reached a stage where hair can be used as an indicator in the initial screening of groups of people or even individuals for contamination. Subsequent screening should include the analysis of other tissues and of various other substrates, so that the emphasis will shift towards the use of nuclear methods in the analysis of tissues other than hair and of excreta.

F.154. When sufficient data on concentrations of contaminants in man have been compiled and a scientific basis for comparing the hazards from radioactive and non-radioactive pollutants has been worked out, an attempt will be made to compare the health impacts of pollutants from nuclear and non-nuclear power generation facilities.

STRUCTURE

F.155. This sub-programme consists of two components, which are described in the following paragraphs.

Health-related environmental research

Summary by programme components

Table F. 7

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Nuclear methods for studying and monitoring environmental pollution	2.2	0.9	123 800	14 000	30 000	6 200	174 000
Health impacts of radioactive and chemical pollutants	1.0	0.3	58 100	11 000	15 000	900	85 000
Linguistic services	-	-	-	-	-	11 000	11 000
Printing and publishing services	-	-	-	-	-	15 000	15 000
Data processing services	-	-	-	-	-	7 000	7 000
TOTAL	3.2	1.2	181 900	25 000	45 000	40 100	292 000

Nuclear methods for studying and monitoring environmental pollution

Objective

F.156. The objective is to develop new nuclear techniques for use in environmental research and improve existing ones and to co-ordinate the testing at laboratories in Member States of nuclear techniques for monitoring trace element pollutants.

Results to date

F.157. Through a co-ordinated research programme (Table F.8, No. 13), a considerable amount of information showing that the chemical composition of human hair as determined by nuclear and other methods reflects the exposure of man to (or, in many cases, his internal contamination by) trace element pollutants has been collected. In this programme, a variety of techniques is being used in Member States (for example, reactor neutron activation analysis; analysis following activation by accelerator-generated fast neutrons, photons and charged particles and analysis on the basis of particle-induced X-ray emission). A technical report on the activation analysis of human hair was issued in 1977.

Plans for 1979-80

F. 158. A co-ordinated research programme on the development of nuclear methods for use in monitoring trace element pollutants will be initiated as a follow-up to the current programme on pollutants in human hair, analyses being performed of other tissues and various other substrates from groups of people and individuals considered on the basis of hair analyses to be contaminated.

F. 159. Intercomparison studies will be carried out through the dispatch of standard biological samples for analysis to laboratories participating in the follow-up co-ordinated research programme.

F. 160. A major course of training in the use of nuclear-based methods for the biological monitoring of trace element pollutants will be given in 1979 (Seminar - Annex I (13)) and recommendations regarding future Agency activities in this field will be formulated in 1980 in the light of a review of current information (Advisory Group).

Related activities

F. 161. Standard biological samples for intercomparison studies will be prepared at Seibersdorf. A health-related research project on environmental pollution using nuclear techniques, arranged under the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology[F.1], will be supported by the Agency.

Plans for 1981-84

F. 162. Work will be extended to the immediate environment of man (with the emphasis on food and drinking water) and additional nuclear methods, including methods based on molecular analysis, will be used.

Co-operation with other organizations

F. 163. Co-operation with WHO and UNEP will continue and contacts will be maintained with UNESCO and ICSU's Scientific Committee on Problems of the Environment (SCOPE). Efforts will be made to obtain financial support for these activities from UNEP.

Health impacts of radioactive and chemical pollutants

Objective

F. 164. The objective is to collect, evaluate and disseminate data on the health impacts of radioactive as compared with chemical pollutants resulting from power production (1977-84).

Results to date

F. 165. A preliminary study of the health impacts of nuclear and non-nuclear power generation has shown that, with all the criteria applied so far, the hazardous health effects per unit of power generated are much less in the case of nuclear power generation. The concept of "dose commitment" has proved to be applicable also to trace element contaminants from non-nuclear industries.

[F.1] Reproduced in document INFCIRC/167.

Plans for 1979-80

F. 166. The health impacts of non-nuclear power generation will be studied on the basis of data obtained from a variety of sources; the main emphasis will be on the contamination of man by trace elements and the resulting health effects relative to the health effects of radioisotopes.

F. 167. Preparations will be made in 1979 (Advisory Group - Annex II (82)) for consideration in 1980 of the scientific foundations for comparing the health impacts of nuclear and non-nuclear power generation and for an examination of factual data on the hazardous effects of various energy sources on public health (Symposium - Annex III (10)).

Plans for 1981-84

F. 168. Health impact commitments of nuclear and non-nuclear power generation will be compared, information being distributed to Member States in order to permit a more objective assessment of the relative hazards from nuclear and non-nuclear power generation.

Co-operation with other organizations

F. 169. Co-operation with WHO, UNEP, UNESCO (under its "Man and the Biosphere" programme) and SCOPE is foreseen.

Co-ordinated research programmes

Table F. 8

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
1. In vitro assay techniques	4	-	1974	1978
2. In vitro procedures, such as radioimmuno- and radio-receptor assays, in reproductive physiology	2	2	1974	1979
3. Medical applications of activation analysis	2	3	1972	1978
4. Comparative methods for the study of trace elements in human nutrition	3	1	1975	1980
5. Maintenance of nuclear instrumentation in developing countries	9	-	1977	1982
6. Development of a transfer instrument for neutron dosimetry intercomparison	2	3	1974	1978

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
7. Use of nuclear techniques in the preparation of vaccines against parasitic diseases	3	3	1972	1980
8. Improvement in radiotherapy of cancer using modifiers of radiosensitivity of cells	9	4	1975	1980
9. Radiation biology of Auger emitters and their therapeutic applications	-	4	1976	1981
10. Practices for the radiation sterilization of medical supplies in countries of Asia and the Pacific region	8	1	1976	1981
11. Comparative biological hazards from low-level radiations and major chemical pollutants	3	3	1977	1982
12. Radiation-induced chromosomal aberrations for genetic risk evaluation in man	9	4	1975	1980
13. Nuclear-based methods for the analysis of pollutants in human hair	5	7	1975	1980

G. PHYSICAL SCIENCES

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table G. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	969 025	1 120 000	70 000	4 000	74 000	1 194 000	1 389 000
Consultants	105 994	149 000	8 500	(6 500)	2 000	151 000	103 000
Overtime	-	-	-	-	-	-	-
Temporary assistance	14 039	27 000	1 600	(2 500)	(900)	26 100	11 000
Sub-total	1 089 058	1 296 000	80 100	(5 000)	75 100	1 371 100	1 503 000
Common staff costs	267 769	324 500	8 800	1 000	9 800	334 300	381 400
Travel	31 275	39 500	2 700	(4 000)	(1 300)	38 200	58 200
Meetings							
Conferences, symposia, seminars	70 497	155 000	3 000	(69 000)	(66 000)	89 000	236 000
Technical committees, advisory groups	102 058	126 000	5 000	(31 000)	(26 000)	100 000	137 600
Representation and hospitality	4 102	8 400	400	(2 600)	(2 200)	6 200	8 500
Scientific and technical contracts	212 755	269 000	13 500	4 500	18 000	287 000	427 000
Scientific supplies and equipment	16 389	15 000	1 200	7 400	8 600	23 600	35 000
Common services, supplies and equipment	2 071	600	-	6 000	6 000	6 600	5 300
Other items of expenditure	-	1 000	-	(1 000)	(1 000)	-	-
Transfer of costs:							
Linguistic services	69 300	71 000	3 500	2 500	6 000	77 000	92 000
Printing and publishing services	309 857	402 000	22 500	50 500	73 000	475 000	550 000
Data processing services	85 728	94 000	1 800	53 200	55 000	149 000	175 000
Laboratory services	1 656 830	1 582 000	82 000	172 000	254 000	1 836 000	1 960 000
TOTAL	3 917 689	4 384 000	224 500	184 500	409 000	4 793 000	5 569 000

SUMMARY OF MANPOWER

Table G. 2

Grade of post	Number of established posts					1980 Preliminary estimate
	1977 Adjusted	1978	1978 Adjusted	Change	1979	
D	1	1	1	-	1	1
P-5	6	6	6	-	6	6
P-4	10	10	10	-	10	11
P-3	5	6	6	-	6	8
P-2	2	2	2	1	3	3
P-1	1	1	1	(1)	-	-
Sub-total	25	26	26	-	26	29
GS	17	17	17	-	17	19
TOTAL	42	43	43	-	43	48

CHANGES IN COSTS AND MANPOWER

Costs

- G.1. As will be seen from Table G.1 above, the cost of this programme is expected to increase by \$409 000, of which \$224 500 will be required to cover salary and other price increases and \$184 500 will be a programme increase.
- G.2. The programme increase of \$5000 in respect of salaries for established posts and common staff costs is due to the fact that posts for which recruitment has been delayed in 1978 will be filled throughout 1979. Programme decreases are foreseen in respect of consultants' services (\$6500), temporary assistance (\$2500) and duty travel (\$4000).
- G.3. It is planned to hold three symposia and seminars in 1979, compared with the four foreseen in the 1978 budget; the reduction in the number of meetings planned and the fact that the 1979 meetings will be smaller than those held in 1978 mean a programme reduction of \$69 000. Although it is planned to increase the number of technical committee and advisory group meetings from 10 in the 1978 budget to 11 in the estimates for 1979, a programme decrease of \$31 000 is foreseen due to a reduction in interpretation services and a lower number of invited participants. The programme reduction of \$2600 in respect of hospitality reflects actual requirements in 1977.
- G.4. A programme increase of \$4500 is foreseen in respect of scientific and technical contracts. The "Nuclear data" sub-programme will require additional funds for targets and samples, resulting in a programme increase of \$7400 under "Scientific supplies and equipment". The programme increase of \$6000 in respect of common services, supplies and equipment is due mainly to the equipment required under the "Isotope hydrology" sub-programme to supplement the existing minicomputer. In the 1978 budget, an amount of \$1000 was provided for training under "Other items of expenditure"; there is no such requirement in the 1979 estimates.
- G.5. As regards service costs, programme increases are foreseen in respect of linguistic services (\$2500), printing and publishing services (\$50 500) and data processing services (\$53 200). The programme increase of \$172 000 in respect of laboratory services is attributable to the cost of setting up the Hydrology Laboratory in the Permanent Headquarters and to the fact that part of the work carried out at the Safeguards Analytical Laboratory is in support of the "Physical Sciences" programme (see Table H.3).

Manpower

- G.6. As will be seen from Table G.2 above, the reclassification of one Professional post from the P-1 to the P-2 level is foreseen. A detailed justification is provided in Annex V.
- G.7. For 1980, the addition of three Professional and two GS posts for the "Nuclear data" sub-programme is foreseen, subject to the result of a review of the atomic and molecular data activities initiated on a trial basis in 1976.

THE PROGRAMME

OBJECTIVE

- G.8. The objective is to stimulate research, to co-ordinate the efforts of scientists and to promote the exchange of nuclear data and of information and data relating to physics,

chemistry, industrial applications of isotopes and isotope hydrology, special attention being devoted to fusion research, to raw material and water resources problems and to education and training in nuclear science and techniques.

STRUCTURE

G. 9. The programme consists of four sub-programmes, which are dealt with separately below.

Summary of manpower and costs by sub-programme

Table G. 3

Sub-programme	1979 Estimate			1980 Preliminary estimate		
	Man-years P	Man-years GS	Costs	Man-years P	Man-years GS	Costs
Physics	4.3	2.3	622 000	4.3	2.3	812 000
Industrial applications and chemistry	5.2	2.2	1 988 000	5.2	2.2	2 112 000
Isotope hydrology	4.2	3.2	1 019 000	4.2	3.2	1 126 000
Nuclear data	12.3	9.3	1 164 000	15.3	11.3	1 519 000
TOTAL	26.0	17.0	4 793 000	29.0	19.0	5 569 000

SUB - PROGRAMMES

Physics

OBJECTIVE

G. 10. The objective is to provide consultative and evaluative services in applied and fundamental physics, through activities (such as the holding of meetings and the issuing of publications) in the field of information exchange and, where appropriate, the preparation of reviews and position papers for special international programmes (the activities relating to fundamental physics are carried out by the International Centre for Theoretical Physics - see chapter I).

PLANS FOR 1979-84

G. 11. Activities will be concentrated on aspects of nuclear physics of particular interest to developing countries - for example, the use of low-energy accelerators and neutron generators and the development and application of nuclear techniques such as Mössbauer spectroscopy, techniques based on nuclear track formation and positron annihilation techniques.

G. 12. The use of research reactors will be promoted on a regional basis through the provision of advice and the organization and co-ordination of research programmes in selected fields such as fuel characterization, neutron diffraction and inelastic scattering.

G. 13. Work relating to plasma physics and fusion research - including the exchange of information on experimental results, theories and fusion reactor designs - will continue and international collaboration among scientists involved in national programmes will be promoted through the International Fusion Research Council (IFRC) with a view to accelerating progress

towards the demonstration of fusion power. Laboratories in countries other than those engaged in major fusion research projects will be informed of areas where - in the opinion of consultants convened by the Agency - they can do useful research.

STRUCTURE

G. 14. The sub-programme consists of three components, which are dealt with separately below.

Physics

Summary by programme components

Table G. 4

Programme component	Man-years		1979 Cost estimates				
	P	GS	Staff	Meetings	Contracts	Other	Total
Nuclear physics	1.1	0.5	70 900	29 500	30 000	2 600	133 000
Utilization of research reactors	1.1	0.5	65 700	11 000	45 000	2 300	124 000
Plasma physics and controlled fusion research	2.1	1.3	122 700	21 800	30 000	7 500	182 000
Linguistic services						23 000	23 000
Printing and publishing services						145 000	145 000
Data processing services						15 000	15 000
TOTAL	4.3	2.3	259 300	62 300	105 000	195 400	622 000

Nuclear physics

Objective

G. 15. The objective is to review the status of research in selected areas, to advise on, encourage and co-ordinate research work in developing countries, with emphasis on the utilization of accelerators and neutron generators (1967-continuing), minicomputers and microprocessors in nuclear science (1974-82) and the development and application of nuclear techniques - especially Mössbauer spectroscopy (1972-82), X-ray fluorescence spectroscopy (1972-80) and nuclear resonance techniques (NMR, EPR) and positron annihilation techniques (1968-82) - and to assist educational institutions in developing countries in establishing teaching and research laboratories for nuclear studies (1977-continuing).

Results to date

G. 16. The series of Agency symposia on the physics and chemistry of fission (1965, 1969, 1973) has come to be regarded as an important means of information exchange, each meeting being considered a milestone in the history of fission studies. Investigations at laboratories in developing countries promoted through technical assistance projects and research contracts have yielded valuable data on fast-neutron-induced fission, fission fragment distributions and long-range particles emitted in ternary fission.

G. 17. A number of regional seminars have been held for the purpose of stimulating the better utilization of low-energy accelerators. At these seminars and at other meetings, the emphasis has been on the use of accelerators in applied research which can be undertaken

using any low-energy accelerator with reasonable instrumentation by experimentalists previously engaged in fundamental studies; several accelerator laboratories have modified their programmes and become successful in performing tasks of importance for local industries. Under the Agency's technical assistance programme, over ten neutron generators have been supplied to developing countries; most of them are being profitably utilized for fast-neutron activation analysis, fission research and reactor physics studies. A co-ordinated research programme on the use of proton-induced X-ray emission in trace element analysis has produced important results relating to such questions as sensitivity limits and the precision of quantitative multi-elemental analysis. (Table G.8, No. 1.)

G. 18. The status and further development of present nuclear techniques (including positron annihilation techniques, neutron- and charge-particle-induced activation techniques and nuclear resonance techniques) and also their application in various areas of science and technology, have been discussed at a number of meetings; work on the development of methods for applying Mössbauer spectroscopy in various fields has been done under a co-ordinated research programme (Table G.8, No. 3). Several projects have been implemented under the Agency's technical assistance programme. A programme for technology transfer in the field of nuclear electronics (with emphasis on the use of microprocessors in nuclear science) has been initiated, with a number of technical assistance projects and an annual advanced training course.

Plans for 1979-80

G. 19. Further advances in work on the physics and chemistry of fission will be reviewed in 1979 (Symposium - Annex I (14)). Support is planned for studies (under several research contracts) of the mechanism of fast-neutron-induced fission.

G. 20. Within the framework of the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA) [G. 1], co-ordinated research activities aimed at stimulating the use of low-energy accelerators and neutron generators in South East Asia are planned. The question of the requirements for the optimum design of an inexpensive medium-flux generator for use in fundamental and applied research will be examined.

G. 21. The use of nuclear techniques in studying hydrogen storage in metals and metallic compounds (a question of special practical importance) will be the subject of a consultants' meeting in 1980. Questions regarding the use of microprocessors in nuclear electronics will be examined in 1980 (Advisory Group). Particular attention will be paid (through co-ordinated research programmes and technical assistance projects) to the introduction of simple and inexpensive nuclear techniques - such as techniques based on nuclear track formation - which are of value in education and applied research.

Plans for 1981-84

G. 22. There will be strong emphasis on subjects of interest to developing countries - for example, advanced uses of low-energy accelerators (under the Agency's technical assistance programme and through research contracts), the application of nuclear techniques in applied research and the introduction of electronic systems based on the latest generation of small computers. Academic research will be represented by heavy-ion-induced X-ray fluorescence, a form of X-ray fluorescence which should be of considerable practical importance by 1979.

[G. 1] Reproduced in document INFCIRC/167.

Co-operation with other organizations

G. 23. Except for fission studies, the activities comprising this component will involve considerable co-operation with the Division of Technical Assistance and the Contracts Administration Section.

Utilization of research reactors

Objective

G. 24. The objective is to assist in research planning and research reactor utilization (1976-continuing); to advise on reactor utilization programmes; to promote the efficient use of research reactors in developing countries by advising on and organizing training and co-ordinated research in selected fields, such as neutron diffractometry and inelastic scattering (1962-81) and radioisotope production and quality control (1966-continuing); and to compile and publish data on research reactors (1978-continuing).

Results to date

G. 25. Regional meetings devoted to the general problem of research reactor utilization have been held almost every year; they have included topics such as isotope production, neutron activation analysis, nuclear physics, neutron physics, solid-state physics and reactor operation (safety and maintenance).

G. 26. The series of Agency symposia on neutron inelastic scattering has played an important role in improving the quality of solid-state physics research involving the use of neutrons; numerous laboratories in developing countries are now producing excellent results in this type of research, which has been introduced at most research reactor establishments. Interest in using neutron scattering techniques in applied research (mainly metallurgy and chemistry) has been emphasized at advisory group and consultants' meetings. Work on applying research reactor neutron scattering techniques in the study of solids has been promoted through a co-ordinated research programme (Table G. 8, No. 2).

G. 27. Programmes have been formulated for the use of research reactors in fuel characterization studies (in co-operation with the "Fuel element technology and reliability" component) and in the training of nuclear power project personnel in safety matters (in co-operation with the "Nuclear manpower development" and "Nuclear safety research and development" components).

Plans for 1979-80

G. 28. Guidelines for the formulation and management of research programmes involving the use of research reactors in developing countries will be prepared in 1979 (Advisory Group - Annex II (83)).

G. 29. Within the framework of RCA, the use of research reactors in nuclear manpower development (particularly the training of persons who will have regulatory duties in developing countries) will be stimulated through safety-related research projects. The general question of the role of research reactor establishments in nuclear manpower development will be reviewed in 1980 (Advisory Group).

G. 30. Studies concerning the use of low- and medium-enriched fuels in research reactors will continue in the light of the recommendations of an advisory group on research reactor renewal and up-grading programmes which is meeting this year. Guidelines on programmes for renewing research reactor instrumentation will be formulated with the help of consultants.

G. 31. Following completion of the present co-ordinated research programme on the use of research reactor neutron scattering techniques in the study of solids, co-ordinated research relating to their use in fuel characterization and in applied research will be initiated. Recent developments in the field of small-angle neutron scattering instrumentation and applications will be reviewed in 1980 (Technical Committee).

G. 32. Training aimed at ensuring that optimum use is made of research reactors and neutron generators in developing countries and (in co-operation with the Division of Nuclear Power and Reactors and the Division of Nuclear Safety and Environmental Protection) training in the use of computer codes for such purposes as reactor fuel management and calculations in the nuclear safety area will be organized in 1980 (Seminars).

G. 33. A computerized research reactor data file which is being established at present will be continuously up-dated and data will be made available on request.

Related activities

G. 34. Advice will be given on the acquisition and construction of research reactors and the construction of associated laboratories and on the renewal and up-grading of such facilities.

Plans for 1981-84

G. 35. The organization of regional seminars on selected subjects involving the use of research reactors will continue, account being taken of the impact of such seminars on the research programmes of interested countries.

G. 36. Investigations involving the use of neutron beam techniques, research projects with a safety-related component and research reactor fuel questions will continue to be important elements of this component.

Plasma physics and controlled fusion research

Objective

G. 37. The objective is to assist leaders of national fusion programmes in the co-ordination of research by exchanging information through the work of the International Fusion Research Council (IFRC), to review and assess specific activities in the areas of fusion research and technology, and to assist - upon request from Member States - in the direct co-ordination of selected projects.

Results to date

G. 38. The Physics Section assisted with the establishment, in 1970, of IFRC and provides the scientific secretary. On IFRC's advice, the Agency initiated studies on fusion power and the environment, the publication of the "World Survey of Major Facilities in Controlled Fusion Research" (1973 and 1976) and the collation and dissemination of atomic and molecular data for fusion.

G. 39. In 1977, at the request of the Agency, IFRC up-dated the "Status Report on Controlled Nuclear Fusion", which summarizes progress in fusion research and discusses the future role of fusion, and made recommendations to the Agency on its fusion programme.

G. 40. The latest of the Agency's regular international conferences on plasma physics and controlled nuclear fusion research took place in 1976. Several specialists' meetings on magnetic and inertial confinement systems, plasma theory and fusion reactor designs have been organized in co-operation with other Divisions.

G. 41. Research at laboratories in developing and advanced countries on interactions between energetic particles and materials of importance for the construction of fusion reactors has been co-ordinated (Table G. 8, No. 5); the objectives and priorities of the co-ordinated research programme have been determined by consultants and by the Atomic and Molecular Data Group of the Nuclear Data Section.

G. 42. Member States have been invited to submit forecasts of attainable fusion research and development goals in order that the Agency may obtain a better idea of where greater international co-operation would be most useful.

Plans for 1979-80

G. 43. In line with recommendations made by IFRC in the "Status Report on Controlled Fusion Research", international co-operation regarding future fusion reactor materials requirements, in environmental studies and in the establishment of computer systems and programmes for use in fusion research will be encouraged.

G. 44. If Member States show sufficient interest, steps to create a worldwide study group which would consider the next major advance towards the demonstration of fusion power will be pursued.

G. 45. The next of the Agency's regular international conferences on plasma physics and controlled fusion research will take place in 1980 (Conference - Annex III (12)). Questions relating to impurities, to alternative confinement systems, to reactor concepts involving inertial confinement and to high-power auxiliary heating will be reviewed in 1979 (Technical Committees - Annex II (84-87)); in 1980, questions relating to the fabrication of targets for inertial-confinement experiments (Technical Committee), to large toroidal experiments (Advisory Group) and to heat and particle transport in toroidal-confinement systems (Technical Committee) will be reviewed.

G. 46. Suggestions for fusion research which does not require large apparatus and which could be tackled by laboratories in developing countries will be formulated at consultants' meetings; such research may be initiated through co-ordinated research programmes.

Plans for 1981-84

G. 47. As international activities in controlled fusion research expand further, a large-scale international fusion reactor project may be initiated with the Agency playing a central role and enabling countries which are less advanced in controlled fusion research to contribute to research on fusion power generation.

G. 48. In addition to IFRC meetings and the Agency's regular international conferences, meetings on a variety of technical questions will be organized in collaboration with other Divisions.

G. 49. Co-ordinated research programmes in which the expertise and facilities of developing countries can be used will be supported.

Co-operation with other organizations

G. 50. The Agency will continue to co-ordinate its activities with IEA through IFRC, some of whose members represent that organization.

Industrial applications and chemistry

OBJECTIVE

G. 51. The objective is to review the status of technology for producing radioisotopes and stable isotopes and of nuclear techniques for materials testing and analysis; to examine chemical problems associated with fission and fusion reactor technology; to assist in the development of industrial radiation processing using cobalt-60 sources and accelerators; to encourage the production and use of radioisotopes and stable (including activable) isotopes and the use of nuclear techniques in prospecting for oil, coal and minerals; to review the status of X-ray and neutron techniques for industrial process control and examine the

technical-economic factors associated with their use; to consider the use of nuclear techniques in the study of chemical bonding; to evaluate and publish data on the chemical thermodynamics of actinide elements and their compounds; to maintain awareness of the status of work on developing standard reference materials for use in nuclear fuel studies and in safeguards and of the requirements which must be met by such materials; and to advise on nuclear techniques for the non-destructive testing of materials.

PLANS FOR 1979-84

G. 52. Work under the "Materials testing and analysis" component will be broadened to include in situ prospecting for mineral resources and their exploitation and the detection of trace elements and organic compounds. Research relating to the use of automated nucleonic systems for control purposes will be expanded and co-ordinated; comparisons will be made of nuclear-based on-line control techniques and non-nuclear control techniques. The potential role of nuclear techniques in various industrial operations will be assessed. The organization of industrial radiography services in developing countries will be promoted.

G. 53. The production of stable and radioactive isotopes and their compounds will be supported, with particular emphasis on the use of cyclotrons and the separation of fission products of high specific activity. Other work will centre on the development of special radiation techniques for use in ion implantation and catalysis, on the development of membranes for energy conversion devices and on technology for the use of large radiation sources in treating textiles, rubber, composite materials and polymers. An extension of activities to subjects such as electronics, bio-engineering and metallurgy is envisaged. Studies concerning the economics of radioisotope applications will continue; in particular, cost-benefit studies on the use of tracers in studying process dynamics will be supported.

G. 54. Under the "Chemistry" component, emphasis will be placed on chemical and thermodynamic aspects of nuclear reactor technology, particular attention being paid to topics such as fuel chemistry, reactor safety and standard reference materials for use in the analysis of nuclear fuels and for safeguards purposes. In addition, chemical problems associated with potential fusion reactor materials will be considered.

G. 55. Research contracts will be awarded and advice given to Member States in connection with many of the above activities.

STRUCTURE

G. 56. This sub-programme consists of three components, which are described in the following paragraphs.

Industrial applications and chemistry

Summary by programme components

Table G. 5

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Materials testing and analysis	1.0	0.8	69 300	8 000	20 000	1 700	99 000
Production and industrial use of radiation sources	2.1	0.7	137 400	22 200	40 000	6 400	206 000
Chemistry	2.1	0.7	127 100	43 000	40 000	1 900	212 000
Linguistic services						10 000	10 000
Printing and publishing services						155 000	155 000
Laboratory services						1 306 000	1 306 000
TOTAL	5.2	2.2	333 800	73 200	100 000	1 481 000	1 988 000

Materials testing and analysis

Objective

G. 57. The objective is to review the status of research in selected areas and to advise on, encourage and co-ordinate work in developing countries, with emphasis on: nuclear-based techniques for materials testing and composition analysis in process and product control, the exploitation of natural resources, industrial safety and pollution control; neutron activation analysis with prompt and decay gamma ray techniques, energy-dispersive X-ray fluorescence techniques and nuclear logging techniques for mineral prospecting and oil and coal exploration (1969-84); X-ray and neutron techniques for industrial process control (1976-84); nuclear techniques for the non-destructive testing of materials (1973-80); and automated nucleonic systems for control purposes (1979-84).

Results to date

G. 58. In 1973, practical aspects of activation analysis were considered by a panel and questions concerning analytical quality control and reference materials by a group of consultants. The current status of applications of nuclear techniques in mineral exploration, extraction and processing was reviewed in 1974 (by a panel) and in 1977 (at a symposium). A symposium on the use of nuclear techniques in the analysis of environmental pollutants was held in 1976.

G. 59. Progress in the development of X-ray and neutron techniques for process control in basic metal industries was reviewed at a symposium in 1972. Arrangements have been made for an advisory group to consider practical aspects of energy-dispersive X-ray fluorescence analysis this year.

G. 60. Some twenty technical assistance projects aimed at encouraging the use of nucleonic instruments in materials analysis have been implemented.

G. 61. Since 1976, co-ordinated research programmes on the use of X-ray and neutron techniques in industrial process control (Table G. 8, No. 9) and the use of electron capture detectors in gas chromatography (Table G. 8, No. 11) have been initiated. The use of nuclear-based techniques in geology and mineral prospecting has continued to be encouraged through co-ordinated research (Table G. 8, No. 10).

G. 62. A training course on the use of radiography in materials testing and a consultants' meeting on neutron radiography have been held. The use of non-destructive testing methods in developing countries has been encouraged through research contracts and technical assistance projects.

G. 63. In 1977, an economic study of the large-scale use of nuclear techniques in mineral exploration, mining and processing was initiated.

Plans for 1979-80

G. 64. Research and cost-benefit studies relating to automated nucleonic systems for control purposes will be co-ordinated; the plans for a co-ordinated research programme are being finalized this year. The use of isotope techniques in investigating new energy sources and in energy-saving will be considered in 1979 (Advisory Group - Annex II (89)). The use of nuclear techniques in achieving greater industrial safety and in pollution control will be considered in 1980 (Advisory Group). Training in the use of nuclear techniques in mineral resources development will be given in 1980 for participants from African countries (Seminar).

Related activities

G. 65. An interregional training course on recently developed nuclear techniques for use in mineral exploration, mining and processing is planned for 1979; in this connection,

research and development work in developing countries (particularly African countries) will be encouraged and technical advice will be given.

G. 66. A training course on non-destructive testing is planned for 1979 or 1980. Research contracts will continue to be awarded in the light of the needs of developing countries.

Plans for 1981-84

G. 67. Increasing emphasis will be placed on the analysis of trace elements and organic compounds and on the use of nuclear-based analytical techniques in in situ prospecting for minerals. More work on the use of neutron activation analysis, X-ray fluorescence spectrometry and prompt gamma ray techniques in mineral exploitation is envisaged. Research relating to automated nucleonic systems for control purposes will be expanded and will continue to be co-ordinated. The holding of meetings and the awarding of research contracts designed to encourage the use of nuclear techniques in organic analysis will be supported.

G. 68. Comparisons will be made of nuclear-based on-line control techniques and non-nuclear control techniques. The potential role of nuclear techniques in various industrial operations will be assessed on the basis of case studies.

G. 69. The organization of industrial radiography services in countries which are undergoing industrialization will be promoted; in the case of neutron radiography, countries will be encouraged to make maximum use of the research reactors which they have available.

Co-operation with other organizations

G. 70. This component may involve co-operation with UNIDO, ECOSOC's Committee on Natural Resources and other United Nations bodies and with various governmental organizations.

Production and industrial use of radiation sources

Objective

G. 71. The objective is to review the status of research and development work on radioactive and other radiation sources, with emphasis on: expanding the use of isotopes and radiation in industry under the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (1978-85); cobalt-60 irradiation facilities for industrial radiation processing (1973-80); radioisotope production technology using nuclear reactors and accelerators (1976-82); economic analyses of the production of radioisotopes on an industrial scale; and the preparation of stable isotopes.

Results to date

G. 72. During the past six years, 18 developing countries have been given technical assistance with a view to their becoming self-sufficient in a number of radioisotopes and labelled compounds (especially radiopharmaceuticals). Five large-scale UNDP projects, concerned with radiosterilization and electron beam processing, have been executed. A number of pilot irradiation facilities with cobalt-60 sources have been installed in Member States with the Agency's assistance.

G. 73. Progress in radiation processing has been reviewed at symposia and other meetings. Tracer technology has been discussed at two symposia on environmental studies and at meetings on industrial application of radioisotopes. The separation, determination and biological applications of stable isotopes were reviewed by a technical committee in 1977.

G. 74. The use of tracer techniques in industry has been promoted through training courses and technical assistance projects. In 1977, a training course on the preparation,

control and utilization of radiopharmaceuticals was organized and a co-ordinated research programme on the preparation of radiopharmaceuticals from accelerator-produced isotopes was initiated (Table G.8, No. 6).

G. 75. The status of work on the separation of radioisotopes from nuclear wastes was reviewed at a consultants' meeting in 1977. Experience gained with and programmes for the utilization of nuclear centres in Latin America were analysed in 1977.

G. 76. Preparations have been made for a consultants' meeting on radioisotope economics to take place this year.

Plans for 1979-80

G. 77. Studies of the economic impact of using radioisotopes in industry will continue in 1979 (Technical Committee - Annex II (90)).

G. 78. The status of work on stable-isotope separation by laser excitation will be reviewed in 1979 with the help of consultants. A review - with the help of consultants - of the use of radiotracer techniques in monitoring two-phase flows is also planned, the aim being to widen the industrial application of such techniques. Co-ordinated research programmes on the production and utilization of stable isotopes and their compounds and on the chemistry of radiopharmaceuticals will be initiated during this period.

G. 79. Attention will continue to be paid to radiation systems involving large sources which appear to be of potential value in industry.

Related activities

G. 80. A training course on electron beam processing (with emphasis on the processing of polymers and textiles) will be held in 1979.

G. 81. The needs of developing countries will continue to be met through the provision of technical advice and the awarding of research contracts.

Plans for 1981-84

G. 82. The production of stable isotopes and radioisotopes and of their compounds will continue to be supported through scientific meetings, training courses and co-ordinated research programmes; particular emphasis will be placed on the use of cyclotrons and on the separation of fission products of high specific activity. Other work will centre on the development of special radiation techniques for use in ion implantation and catalysis, on the development of membranes for energy conversion devices and on technology for the use of large radiation sources in treating textiles, rubber, composite materials and polymers.

G. 83. An extension of activities to subjects such as electronics, bio-engineering and metallurgy is envisaged. Cost-benefit studies on the use of tracers in process dynamics will be supported through research contracts.

G. 84. Studies of the economic impact of using radioisotopes in industry will continue.

Co-operation with other organizations

G. 85. This component involves co-operation with national, regional and international organizations, in particular WHO.

Chemistry

Objective

G. 86. The objective is to assist in co-ordinating research on the chemistry and bio-chemistry of radiopharmaceuticals (1978-83); to publicize and advise on the use of recently

developed nuclear techniques for physico-chemical structure studies (1978-80); to determine the situation regarding standard chemical and isotopic materials for the analysis of nuclear fuels and for safeguards applications (1977-79); to review, compile and publish thermodynamic data on actinide compounds (1975-82); to define and advise on materials problems of a chemical nature related to fusion reactor technology (1979-84); to assist in co-ordinating research on the thermodynamic and transport properties of nuclear materials (1978-81); and to review the status of research on oxygen activity changes in oxide fuels due to the effects of burn-up, of oxygen redistribution, of chemical interactions between fuel and cladding and of reactions between fission products and fuel (1979-81).

Results to date

G. 87. In 1974, a panel meeting on the thermodynamics of the uranium-plutonium-carbon system and a symposium on the thermodynamics of nuclear materials were held. In 1977, an advisory group discussed chemical and isotopic standards for nuclear fuel analyses for fuel characterization and safeguards purposes. Several consultants' meetings have been held in connection with the evaluation of data on the chemical thermodynamics of actinide elements and their compounds.

G. 88. A number of research contracts have been awarded for the purpose of stimulating work in several of the areas with which this component is concerned.

G. 89. Preparations have been made for the holding this year of a consultants' meeting to discuss the use of nuclear techniques in the study of chemical bonding.

Plans for 1979-80

G. 90. Information made available since 1974 on the thermodynamics of nuclear materials - with emphasis on the thermodynamics of interactions between nuclear fuels and cladding and on the thermodynamics of advanced fuels - will be reviewed in 1979 (Symposium - Annex I (15)). Also in 1979, oxygen activity changes in oxide fuels due to burn-up (Advisory Group - Annex II (88)) will be reviewed. Questions concerning standard reference materials for use in the analysis of nuclear fuels will be considered in 1980 (Advisory Group).

G. 91. A co-ordinated research programme on thermodynamic and transport properties of nuclear materials (Table G. 8, No. 4) is expected to get fully under way during the period 1979-80.

G. 92. Initial efforts will be made, in co-operation with the Division of Nuclear Power and Reactors, to compile an internationally accepted set of critically evaluated physico-chemical data for use in reactor safety calculations.

G. 93. A training course on basic techniques for use in analytical chemistry will be held in 1980; it will be preceded by a study tour in 1979.

Plans for 1981-84

G. 94. During this period, the last of the planned series of publications on the chemical thermodynamics of actinide elements and their compounds will be issued, whereupon all the data will be critically reappraised and the individual publications consolidated in a single volume.

G. 95. Emphasis will be placed on chemical aspects of nuclear reactor technology, particular attention being paid to topics such as fuel chemistry, reactor safety analyses and standard reference materials for use in the analysis of nuclear fuels. In addition, chemical problems connected with fusion reactor materials will be considered.

G. 96. Technical advice on chemistry problems will be provided to developing Member States. An annual course of training in radiochemistry and analytical chemistry will be instituted.

Co-operation with other organizations

G. 97. This component involves co-operation with various national bodies (such as the Institute of High Temperatures, Moscow) and with organizations such as CEC, IUPAC, ISO and the International Council of Scientific Unions (Committee on Data for Science and Technology).

Isotope hydrology

OBJECTIVE

G. 98. The objective is - in line with recommendations made in 1977 at the United Nations Water Conference and at the second session of the Intergovernmental Council of UNESCO's International Hydrological Programme - to support the development of isotope techniques for use in water studies, by employing such techniques directly in hydrological investigations of practical interest to Member States and by helping Member States to acquire technical competence or increase their capabilities, and to collect and disseminate basic data and information relating to isotope hydrology.

PLANS FOR 1979-84

G. 99. The emphasis will be on the transfer of knowledge concerning the usefulness of isotope techniques as an additional hydrological tool through the organization of regional seminars for hydrologists working at the managerial level, the provision of lecturers for post-graduate training courses in hydrology sponsored by UNESCO and the execution of demonstration projects.

G. 100. Activities will be directed less towards problems arising in the assessment and development of water resources and more towards hydrological problems associated with - for example - site assessments for nuclear power plants and nuclear waste storage facilities.

G. 101. Training in the use of isotope techniques in water resources development will be organized for hydrologists and water managers; in 1979 it will be mainly for persons from French-speaking African countries (Seminar - Annex I (16)) and in 1980 mainly for persons from the Middle East (Seminar).

G. 102. The Working Group on Nuclear Techniques, which was set up under UNESCO's International Hydrological Programme and for which the Agency provides the technical secretariat, will meet in 1979 (Technical Committee - Annex II (92)).

STRUCTURE

G. 103. This sub-programme (which is closely linked with the "Isotope hydrology" sub-programme of the Agency's Laboratory - see chapter H) consists of four components, which are described in the following paragraphs.

Isotope hydrology

Summary by programme components

Table G. 6

Programme component	Man-years		1979 Cost estimates				Total
	P	GS	Staff	Meetings	Contracts	Other	
Precipitation	0.5	1.1	44 600	-	-	2 400	47 000
Surface water	0.8	0.5	53 700	20 000	17 000	2 300	93 000
Groundwater	2.4	1.0	149 700	8 000	20 000	12 300	190 000
Techniques	0.5	0.6	36 900	2 000	18 000	2 100	59 000
Linguistic services						2 000	2 000
Printing and publishing services						80 000	80 000
Data processing services						18 000	18 000
Laboratory services						530 000	530 000
TOTAL	4.2	3.2	204 900	30 000	55 000	649 100	1 019 000

Precipitation

Objective

G. 104. The objective is: (a) to measure the tritium, deuterium and oxygen-18 in monthly precipitation samples collected through a world-wide network of gauge stations and to publish the results periodically (1961-continuing); and (b) to measure the isotopic (and, where necessary, chemical) composition of precipitation samples collected at selected stations of WMO's network for the Global Environmental Monitoring System (GEMS) set up for atmospheric pollution monitoring (1978-82, but may continue).

Results to date

G. 105. The results of the tritium, deuterium and oxygen-18 measurements have been published regularly (recent, as yet unpublished results can be obtained from the Isotope Hydrology Section); also, they have been treated statistically to show the dependence of the deuterium and oxygen-18 content of precipitation on each station's climatic parameters. As data accumulated and a general picture emerged, it became clear that 144 gauge stations were more than enough; accordingly, the number of gauge stations constituting the network was reduced to 65 in 1977.

G. 106. Studies of precipitation and snow accumulation in Chile and Iceland have been supported through research contracts.

Plans for 1979-80

G. 107. In order to correlate the isotopic composition of precipitation with the chemical composition and - possibly - with meteorological parameters, chemical analyses of precipitation samples will be carried out at the Isotope Hydrology Laboratory in addition to isotopic analyses; this is in line with guidelines - formulated in 1977 at a consultants' meeting organized by the Agency in co-operation with WMO - for the integration of the Agency's gauge station network with the GEMS network, which is receiving financial support from UNEP. Participation in WMO meetings on precipitation chemistry and isotope monitoring is also expected.

G. 108. The results of the analyses will be evaluated continuously with regard both to their climatic and meteorological meaning and to their usefulness as input data for groundwater and surface water studies.

Plans for 1981-84

G. 109. Data based on samples from the Agency's gauge station network and from selected GEMS stations will continue to be evaluated.

Co-operation with other organizations

G. 110. This component involves co-operation with WMO and UNEP.

Surface water

Objective

G. 111. The objective is to review and evaluate developments in the application of isotope techniques in surface water investigations, with emphasis on lake dynamics and related geochemical problems and on the application of these techniques in the case of selected lakes (1977-80).

Results to date

G. 112. The use of nuclear techniques in studying the water balance and the water dynamics of lakes was reviewed by an advisory group in 1977. At an advisory group meeting in 1975, it was shown how isotopes can help in elucidating run-off mechanisms.

G. 113. The water balance and the water dynamics of lakes and swamps have been studied by means of isotope techniques in Botswana and Malawi. The interrelations between surface water and groundwater have been investigated in Algeria, Ecuador, Greece, Italy, Jamaica, Mexico, Senegal and Sudan.

G. 114. Single-borehole techniques have been used for investigating leakages in a large reservoir, in co-operation with GSF's Institute of Radiohydrometry and with the Turkish General Directorate of State Hydraulic Works.

Plans for 1979-80

G. 115. Studies of Austrian (and possibly other) lakes exhibiting different characteristics (good mixing, meromixis, seasonal mixing, etc.) will be undertaken in order to demonstrate the possibilities of isotope techniques in limnology. A co-ordinated research programme covering selected lakes in different parts of the world will be initiated.

G. 116. The status of the use of isotope techniques in studying sedimentation rates and sediment transport in freshwater environments, especially in the light of changes introduced by human activities, will be reviewed in 1980.

Related activities

G. 117. Support through the awarding of research contracts will be given to investigations of various aspects of surface water hydrology, including pollution studies (research contracts have recently been awarded to institutes in Iceland, Israel, France, the Netherlands, Nigeria, Poland, Turkey and Yugoslavia).

Plans for 1981-84

G. 118. It is expected that most of the studies of lakes, including those to be carried out under a co-ordinated research programme, will be completed during this period. The

value of isotope techniques in studying surface water pollution (origin and dispersion of pollutants; pollutant sinks) will be assessed.

Co-operation with other organizations

G. 119. It is expected that co-operation with FAO and UNESCO will continue and that there will also be co-operation with WHO and UNEP.

Groundwater

Objective

G. 120. The objective is: (a) to advise and provide services to Member States regarding the solution of hydrological problems connected with water inventories, dynamics and geochemistry (including problems of geothermal prospecting) through the use of environmental isotope techniques combined, if necessary, with hydrogeochemical techniques (1961-continuing); and (b) to review and evaluate applications of isotope techniques in studying hydrological aspects of specialized topics, including groundwater pollution (1976-79) and mining and waste disposal (1977-80).

Results to date

G. 121. Environmental isotope techniques, which often yield results which cannot be obtained by other means, have been used in investigations of the behaviour of water in aquifers to determine the age of groundwater and to trace its movement. As recommended by an advisory group in 1975, facilities for the chemical analysis of water have been installed in the Isotope Hydrology Laboratory, so that the combined use of isotopic and hydrochemical methods is now possible.

G. 122. During the period 1972-77, groundwater field studies were carried out in Algeria, Bolivia, Ecuador, Greece, Guatemala, India (geothermal prospecting), Italy, Jamaica, Lebanon, the Libyan Arab Jamahiriya, Mauritius, Mexico, Nicaragua, Qatar, Senegal, Spain, Sudan, Surinam, Togo, Tunisia and Turkey.

G. 123. Questions concerning the use of isotope techniques in studying various aspects of groundwater hydrology have been considered at symposia, regional seminars, advisory group meetings and consultants' meetings.

Plans for 1979-80

G. 124. Emphasis will be placed on the development of isotope techniques for use in studying hydrology questions such as those connected with mining and waste disposal (Technical Committee - Annex II (91)).

Related activities

G. 125. Activities relating to large-scale UNDP projects and to demonstration projects will be intensified. Consultants will be sent to developing countries to assist in field investigations and to advise on the implementation of hydrology programmes.

G. 126. Support through the awarding of research contracts will be given to investigations of various groundwater problems (research contracts have recently been awarded for field investigations in Algeria, Belgium, Brazil, Cyprus, Egypt, France, Indonesia, Israel, Italy (geothermal research), Turkey and South Africa).

Plans for 1981-84

G. 127. The general lines of the programme will be maintained, but details will be modified to meet current needs - especially those of developing Member States.

Co-operation with other organizations

G. 128. Co-operation with the United Nations, FAO, WHO and UNESCO will continue.

Techniques

Objective

G. 129. The objective is: (a) to assist Member States in establishing the analytical capabilities necessary for them to apply isotope techniques in hydrology and geochemistry (continuing); and (b) to review and evaluate new applications of isotope techniques in hydrology, recent refinements of such techniques and the application of new methods of data treatment (continuing).

Results to date

G. 130. Progress has been made in increasing the possibilities for using isotopic techniques in hydrological studies by developing mathematical models for the treatment of isotopic data; in addition, there have been considerable improvements in the statistical treatment of data.

G. 131. The applicability of isotope techniques, especially single-well techniques, in studying irrigation and drainage problems was discussed at a consultants' meeting in 1976; arrangements have been made for the holding this year of a consultants' meeting to discuss progress in the use of single-well techniques in studying hydraulic problems connected with public engineering works.

G. 132. Under the Agency's technical assistance programme, a number of countries have received advice and support in the establishment of isotope hydrology laboratories and the implementation of hydrology programmes. A number of hydrologists from Member States have been trained in the use of isotope techniques in the Isotope Hydrology Section. Lecturers on isotope hydrology have been provided for post-graduate training courses in hydrology sponsored by UNESCO.

Plans for 1979-84

G. 133. Work on the development of mathematical models for the treatment of isotopic data and on improving the statistical treatment of data will continue, maximum use being made of the Isotope Hydrology Section's desk computer. The activities of the Isotope Hydrology Laboratory, which is housed in the Agency's temporary headquarters, will continue, but they may be affected temporarily during the move to the Donaupark.

G. 134. The state of the art in the field of isotope geochemistry, geochemistry and cosmochemistry will be reviewed in 1980 (Symposium - Annex III (13)), emphasis being placed on studies of isotopic distribution in naturally occurring compounds (which have made a decisive contribution to the development of new ideas in geochemistry and geology) and on the use of isotopic methods in the study of meteorites and lunar samples (which has significantly contributed to the development of cosmochemistry).

Related activities

G. 135. Support through the awarding of research contracts will be given to work on developing and refining techniques such as those based on argon-39, carbon-14 and electrolytic enrichment.

Nuclear data

OBJECTIVE

G. 136. The objective is to assess the status of and the need for nuclear and atomic data, to engage in and co-ordinate the compilation, analysis and exchange of nuclear and atomic data, to support the measurement, evaluation and calculation of nuclear and atomic data and to offer cost-free nuclear and atomic data centre services to Member States, especially those which are developing countries.

PLANS FOR 1979-84

G. 137. The collection and dissemination of neutron and other nuclear reaction data will continue and efforts will be made to improve and extend the data centre services offered to developing countries and to achieve an unrestricted international exchange of evaluated neutron data.

G. 138. Nuclear and atomic data requirements associated with energy and non-energy programmes will continue to be assessed (mainly through scientific meetings, and in co-operation with the International Nuclear Data Committee and the International Fusion Research Council) and to determine the priorities of the Agency's nuclear and atomic data programme. The 10th meeting of the International Nuclear Data Committee will take place in 1980 (Technical Committee).

G. 139. There are plans for the Agency to co-sponsor the 5th International Conference on Nuclear Cross-Sections and Technology, to be held in 1979, and to co-operate in the organization of the next European Nuclear Data Conference, to be held in 1981.

G. 140. In the field of nuclear structure and decay data, where the primary aim is to co-ordinate the international compilation, evaluation and exchange of isotopic nuclear data, it is intended to continue co-operating in the establishment of an international evaluated nuclear structure and decay data file available to all Member States.

G. 141. With regard to atomic and molecular data, efforts will be concentrated on evaluating and following up the programme implemented on a trial basis during the trial period 1977-78; publication of the International Bulletin on Atomic and Molecular Data for Fusion and of the International Index to Atomic Collision Data will continue and a computerized file of evaluated atomic and molecular data for fusion research and technology will be established.

CO-OPERATION WITH OTHER ORGANIZATIONS

G. 142. This sub-programme involves close co-operation with all major regional nuclear and atomic data centres (with the National Nuclear Data Center, the Nuclear Data Project, the Controlled Fusion Atomic Data Center and the atomic data centres of the National Bureau of Standards in the United States; with the nuclear and atomic data centres at Obninsk, Moscow and Leningrad in the Soviet Union; with the NEA Neutron Data Compilation Centre at Saclay, in France; and with nuclear and atomic data centres in the Federal Republic of Germany, Japan and the United Kingdom). It also involves co-operation with the NEA Nuclear Data Committee, CEC's Central Bureau for Nuclear Measurements and ICSU's Committee on Data for Science and Technology.

STRUCTURE

G. 143. This sub-programme consists of three components, which are described in the following paragraphs.

Nuclear data

Summary by programme components

Table G. 7

Programme component	Man-years		1979 Cost estimates				
	P	GS	Staff	Meetings	Contracts	Other	Total
Nuclear reaction data	9.2	5.2	516 200	23 500	13 000	27 300	580 000
Nuclear structure and decay data	2.0	2.0	133 200	-	8 000	3 800	145 000
Atomic and molecular data	1.1	2.1	178 000	-	6 000	2 000	186 000
Linguistic services						42 000	42 000
Printing and publishing services						95 000	95 000
Data processing services						116 000	116 000
TOTAL	12.3	9.3	827 400	23 500	27 000	286 100	1 164 000

Nuclear reaction data

Objective

G. 144. The objective is: to compile, exchange and disseminate experimental and evaluated neutron and charged-particle nuclear data and photonuclear data and make them available upon request to Member States; to co-ordinate the activities of regional data centres; to review the requirements for nuclear reaction data of major importance in nuclear science and technology; and to support and co-ordinate experimental and theoretical research relating to such data (1964-continuing).

Results to date

G. 145. Since the inception of this component in 1964, over 1800 requests have been received (over 700 for nuclear data reports, about 90 for special retrievals and about 1030 for numerical data - of these, about 760 were for experimental data and 270 for evaluated data). In response to these requests, over 46 500 numerical data sets consisting of almost twelve million individual data records have been made available to nuclear scientists and engineers in 47 Member States.

G. 146. CINDA has been published periodically by the Nuclear Data Section since 1970 and is recognized by all neutron and reactor physicists as the basic international index to all measured, calculated and evaluated neutron reaction data. The last issue of this index, CINDA 76/77, contains references to more than 26 000 original neutron data publications.

G. 147. Since 1970, results of neutron data measurements have been systematically collected and exchanged between the Nuclear Data Section and three regional neutron data centres using the computer-based EXFOR system, which was originally designed for this purpose but has now been extended to include also photonuclear and charged-particle nuclear reaction data. Since 1977, neutron and charged-particle nuclear data are being exchanged in the generalized EXFOR format between nuclear reaction data centres.

G. 148. Scientific meetings have been held for the purpose of assessing the need for and reviewing the status of nuclear data of importance in various branches of nuclear technology (fission product nuclear data, transactinium isotope nuclear data, nuclear data for fusion, reactor dosimetry data, delayed-neutron data, etc.). Nuclear data measurements and evaluations have been supported and co-ordinated and targets and sample materials have been supplied for nuclear data measurements in developing countries.

G. 149. A co-ordinated research programme on the intercomparison of evaluations of actinide neutron nuclear data has been initiated (Table G. 8, No. 7).

Plans for 1979-80

G. 150. The expected growth of nuclear power generation, particularly in developing countries, and the growing interest in alternative fuel cycles will require an increase in nuclear data compilation and exchange through the established data centre network and an extension of nuclear reaction data services.

G. 151. The data compilation and exchange activities of the data centres co-operating in the data centre network will continue to be co-ordinated through annual meetings between representatives of the Nuclear Data Section and of the data centres.

G. 152. Developing countries will be assisted in the establishment and use of computerized nuclear data libraries for nuclear reactor design calculations.

G. 153. It is planned to complete in the first half of 1979 the co-operative programme (started in 1972) on the improvement of neutron data for reactor dosimetry and to establish an internationally adopted data file for reactor dosimetry. It is planned subsequently to hold a meeting to review the status of transactinium isotope nuclear data and assess the need for such data in connection with advances in thermal and fast reactor technology, with nuclear waste management and with isotope applications (Advisory Group - Annex II (93)). In 1980, the need for nuclear data for alternative fuel cycles will be assessed and progress in fission product nuclear data research will be reviewed (Advisory Groups). Also in 1980, a course on advances in nuclear physics which are of interest from the point of view of practical application will be organized (Seminar) as part of an extended course on nuclear physics to be held at the International Centre for Theoretical Physics.

G. 154. Topical meetings will be held on specific nuclear data problems which are important to the nuclear programmes of Member States and which require timely and detailed study.

Plans for 1981-84

G. 155. While it is expected that the nuclear reaction data requirements associated with fission reactor technology will be gradually satisfied, nuclear reaction data for fusion reactors and non-energy applications may grow in importance - with increasing emphasis on accuracy.

Nuclear structure and decay data

Objective

G. 156. The objective is: to review the requirements for nuclear structure and decay data of importance in applications of isotopes and ionizing radiation; to co-ordinate internationally and promote the measurement, compilation, evaluation and dissemination of nuclear structure and decay data; and to provide data centre services to users of such data (1972-continuing).

Results to date

G. 157. Since its inception in 1972, the main activity under this component has been the organization of an internationally co-ordinated network of data centres, research groups and individual scientists for the systematic compilation, evaluation and dissemination of nuclear structure and decay data. Three advisory group meetings (held in 1974, 1976 and 1977) have resulted in the adoption of computer-based systems for the exchange of bibliographic and numerical nuclear structure and decay data between the members of the

network and in commitments to contribute to a continuous and complete evaluation of nuclear structure and decay data for all isotope mass chains, the aim being to establish an internationally adopted file of such data.

G. 158. In response to a recommendation made in 1975 by an advisory group on transactinium isotope nuclear data, a co-ordinated research programme on the measurement and evaluation of transactinium isotope nuclear decay data was initiated in 1977 (Table G. 8, No. 8).

Plans for 1979-80

G. 159. Because of the importance of nuclear structure and decay data in nuclear fuel cycle analyses, in nuclear waste disposal and reactor safety studies, in safeguards and in biomedical applications of isotopes, a comprehensive international file of evaluated half-life and associated decay data (with particular emphasis on the fission product and transactinium isotopes) will be established.

G. 160. Meetings of representatives of the data centres participating in the international network for the compilation, evaluation and dissemination of nuclear structure and decay data will be convened at regular intervals for the purpose of co-ordinating the network's activities.

Plans for 1981-84

G. 161. The assessment of nuclear structure and decay data requirements will continue in co-operation with the International Nuclear Data Committee; an advisory group meeting to review the need for nuclear structure and decay data in science and technology will be proposed for 1981. The need for accurate evaluated data is expected to grow, with a simultaneous increase in requests for data services.

Atomic and molecular data

Objective

G. 162. The objective is to review the requirements for bibliographic and numerical atomic and molecular data in nuclear fusion research and technology and to compile, evaluate, publish and disseminate such data (in co-operation with regional data centres) (1975).

Results to date

G. 163. This component, which was initiated in 1975 on the recommendation of the International Fusion Research Council, is nearing the end of a two-year trial period (1977-78) during which the staff involved has consisted of three consultants at the Professional level and two temporary assistants at the GS level.

G. 164. An advisory group on atomic and molecular data for fusion met in 1976 and identified areas where there is an urgent need for atomic and molecular data for fusion, reviewed national programmes in the atomic and molecular data field and formulated technical recommendations for the Agency's atomic and molecular data activities. In 1977, representatives of national atomic data centres and groups laid the foundations for international co-operation in the systematic worldwide compilation, evaluation and dissemination of atomic and molecular data required for fusion.

G. 165. The publication of a quarterly "International Bulletin on Atomic and Molecular Data for Fusion", designed to assist in fusion research and in the development of fusion technology by providing scientists and engineers with recently determined and unpublished atomic and molecular data, started in 1977.

G. 166. Work has been done on the creation of a computerized index of references to atomic collision data; this index, which contains material from several Member States, is scheduled to appear by the end of this year.

G. 167. During the two-year trial period, the work being done under this component has been undergoing continuous evaluation by a joint committee set up by the International Fusion Research Council and the International Nuclear Data Committee.

Plans for 1979-80

G. 168. If the results of the evaluation are positive, this component will be established on a permanent basis, the emphasis being placed on the continuing publication of the International Bulletin on Atomic and Molecular Data for Fusion and of the index of references to atomic collision data.

G. 169. It is planned to formulate - in co-operation with various data centres and groups - an international programme for the co-ordinated compilation and evaluation of atomic data relevant to fusion and to create a computerized file of evaluated atomic and molecular data. The fusion community's atomic and molecular data requirements will be assessed and the current situation reviewed in 1980 (Advisory Group).

Plans for 1981-84

G. 170. Emphasis will be placed on the formulation of criteria and guidelines for the evaluation of atomic and molecular data, on the awarding of research contracts to promote the evaluation of urgently needed atomic data and on the further development (in close co-operation with fusion and atomic physicists) of the computerized file of evaluated atomic and molecular data.

Co-ordinated research programmes

Table G. 8

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
1. Elemental analysis by charged-particle-induced X-rays	7	4	1974	1978
2. Application of research reactor neutron scattering techniques in the study of solids	7	-	1973	1978
3. Development of methods for the application of Mössbauer spectroscopy in mineralogy, soil sciences and the study of ceramics	5	1	1977	1980
4. Thermodynamic and transport properties of nuclear materials	This programme has been approved but no contract has yet been awarded.			

5. Energetic particle interactions with materials of importance for fusion reactors	7	3	1976	1980
6. Preparation of radiopharmaceuticals from accelerator-produced isotopes	2	6	1977	1982
7. Intercomparison of evaluations of actinide neutron nuclear data	3	5	1977	1980
8. Measurement and evaluation of transactinium isotope nuclear decay data	This programme has been approved but no contract has yet been awarded.			
9. On-line X-ray and neutron techniques for industrial process control	2	1	1976	1981
10. Nuclear-based techniques in geology and mineral prospecting	2	2	1972	1978
11. Use of electron capture gas chromatography in organic analysis	2	-	1977	1982

H. THE LABORATORY

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table H.1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	1 753 519	2 075 000	131 000	18 000	149 000	2 224 000	2 465 000
Overtime	6 530	8 500	500	(100)	400	8 900	14 000
Temporary assistance	9 722	20 800	600	(11 300)	(10 700)	10 100	11 000
Sub-total	1 769 771	2 104 300	132 100	6 600	138 700	2 243 000	2 490 000
Common staff costs	484 547	601 900	16 400	4 700	21 100	623 000	678 000
Travel	6 618	11 800	700	-	700	12 500	13 000
Scientific and technical contracts	12 179	16 000	1 500	-	1 500	17 500	18 000
Scientific supplies and equipment	312 994	266 000	19 000	38 000	57 000	323 000	580 000
Common services, supplies and equipment	709 182	850 000	28 000	220 000	248 000	1 098 000	906 000
Other items of expenditure	-	1 000	100	1 900	2 000	3 000	3 000
Transfer of costs:							
Linguistic services	18 450	8 000	500	500	1 000	9 000	10 000
Printing and publishing services	6 063	17 000	1 000	(3 000)	(2 000)	15 000	15 000
Data processing services	28 433	35 000	700	14 300	15 000	50 000	55 000
Laboratory services	(3 348 237)	(3 911 000)	(200 000)	(283 000)	(483 000)	(4 394 000)	(4 768 000)
TOTAL	-	-	-	-	-	-	-

SUMMARY OF MANPOWER

Table H.2

Grade of post	Number of established posts					1980 Preliminary estimate
	1977 Adjusted	1978	1978 Adjusted	Change	1979	
P-5	4	4	4	-	4	4
P-4	14	14	13	-	13	14
P-3	5	5	6	1	7	7
P-2	4	4	4	(1)	3	3
P-1	2	2	2	-	2	2
Sub-total	29	29	29	-	29	30
GS	60	60	60	-	60	62
M&O	24	24	24	-	24	27
TOTAL	113	113	113	-	113	119

CHANGES IN COSTS AND MANPOWER

Costs

H. 1. As will be seen from Table H.1 above, the cost of laboratory services is allocated to the programmes for which they are provided. The total cost of laboratory services is expected to increase by \$483 000 of which \$200 000 will be required to cover salary and other price increases and \$283 000 will be a programme increase. This programme increase is related mainly to the "Life Sciences" and "Physical Sciences" programmes (see chapters F and G).

H. 2. The programme increase of \$22 700 in respect of salaries for established posts and common staff costs represents the additional cost in 1979 of posts for which funds were provided in the 1978 budget for only part of the year. A programme reduction of \$11 300 in respect of temporary assistance, which is required mainly in the Safeguards Analytical Laboratory, will be possible.

H. 3. It will be necessary to replace some scientific equipment. In view of the financial implications, however, only the most essential replacements will be made in 1979, resulting in a programme increase of \$38 000 in respect of scientific supplies and equipment.

H. 4. The programme increase of \$220 000 in respect of common services, supplies and equipment is attributable to an increase in the operating costs of the Laboratory. There will be an increase in utility charges and other operating costs for the Laboratory (including the new wing and the Safeguards Analytical Laboratory). Although construction - for which the costs were shown in the 1978 budget - will be completed by the end of this year, an amount of \$120 000 is still required for equipping the new laboratory wing and for transferring the Medical Applications Laboratory and the Dosimetry Laboratory to it.

H. 5. An increase of \$1900 is required in the funds available for training technicians in the Hydrology Laboratory and in the Safeguards Analytical Laboratory.

H. 6. As regards service costs, the increases in respect of linguistic services (\$500) and data processing services (\$14 300) will be partly offset by a decrease of \$3000 in respect of printing and publishing services.

Manpower

H. 7. As will be seen from Table H. 2 above, the upgrading of one Professional post from the P-2 to the P-3 level is foreseen. A detailed justification is provided in Annex V.

H. 8. For 1980, the addition of one Professional post (at the P-4 level) for the "Agriculture" sub-programme, two GS posts and three M&O posts will be required.

THE PROGRAMME

OBJECTIVE

H. 9. The objective is to support (through such activities as the provision of analytical services, the calibration of radionuclides and the development of techniques) the Agency's technical programmes, including safeguards.

STRUCTURE

H.10. This programme consists of seven sub-programmes. The "Medical applications and dosimetry" sub-programme is dealt with under the appropriate sub-programmes of the "Life Sciences" programme. The other six sub-programmes are dealt with separately below.

Summary of manpower and costs by laboratory sub-programmes

Table H. 3

Sub-programme	1979 Estimate				1980 Preliminary estimate			
	P	Man-years GS M&O		Costs	P	Man-years GS M&O		Costs
Metrology								
Provision of radionuclide intercomparison and nuclear spectroscopy services	3.1	5.4	2.3	402 000	3.1	5.4	2.3	458 000
Assistance to the Department of Safeguards	-	0.4	-	20 000	-	0.4	0.4	20 000
Sub-total	3.1	5.8	2.3	422 000	3.1	5.8	2.7	478 000
Chemistry								
Analytical quality control	2.3	3.2	1.4	280 000	2.3	3.7	1.6	320 000
Support in analytical chemistry to Member States, other units within the Agency and other United Nations organizations	1.4	3.8	1.4	188 000	1.4	4.3	1.6	215 000
Support in chemistry to the Agriculture Section of the Laboratory	0.5	1.4	0.5	44 000	0.5	1.4	0.5	45 000
Sub-total	4.2	8.4	3.3	512 000	4.2	9.4	3.7	580 000
Isotope hydrology								
Analytical services	2.9	7.2	-	380 000	2.9	7.2	-	405 000
Preparation and distribution of standards and intercalibration of measurements	1.2	2.5	-	150 000	1.2	2.5	-	165 000
Sub-total	4.1	9.7	-	530 000	4.1	9.7	-	570 000
Medical applications and dosimetry								
	2.1	5.6	1.0	559 000	2.1	5.6	2.0	710 000
Agriculture								
Services to the "Soil fertility, irrigation and crop production" sub-programme of the "Food and Agriculture" programme	2.2	2.6	2.9	280 000	2.5	3.0	3.0	283 000
Services to the "Plant breeding and genetics" sub-programme of the "Food and Agriculture" programme	2.2	2.4	2.9	250 000	2.5	2.8	3.2	252 000
Services to the "Insect and pest control" sub-programme of the "Food and Agriculture" programme	3.4	4.9	4.5	466 000	3.8	5.1	4.5	475 000
Services to the "Chemical residues and pollution" sub-programme of the "Food and Agriculture" programme	0.5	0.5	0.3	66 000	0.5	0.5	0.3	66 000
Sub-total	8.3	10.4	10.6	1 062 000	9.3	11.4	11.0	1 076 000
Safeguards Analytical Laboratory (SAL)								
Analytical and other support for safeguards activities	4.0	8.2	3.0	754 000	4.2	8.3	3.4	792 000
Analytical services in support of other Agency activities	1.0	2.8	1.0	262 000	0.8	2.7	1.0	259 000
Sub-total	5.0	11.0	4.0	1 016 000	5.0	11.0	4.4	1 051 000
Electronics and workshop services								
For the general laboratory	2.0	8.0	2.5	227 000	2.0	8.0	2.9	235 000
For the Department of Safeguards	0.2	1.1	0.3	66 000	0.2	1.1	0.3	68 000
Sub-total	2.2	9.1	2.8	293 000	2.2	9.1	3.2	303 000
TOTAL	29.0	60.0	24.0	4 394 000	30.0	62.0	27.0	4 768 000

Laboratory services: Breakdown of costs by programme

Table H.4

Programme	1977 Actual obligations	1978 Adjusted budget	1979 Estimate	1980 Preliminary estimate
Food and agriculture	806 177	1 105 000	1 130 000	1 143 000
Life sciences	448 450	356 000	588 000	785 000
Physical sciences	1 656 830	1 582 000	1 836 000	1 960 000
Safeguards	436 780	868 000	840 000	880 000
TOTAL	3 348 237	3 911 000	4 394 000	4 768 000

Apportionment of total laboratory costs to relevant sub-programmes

Table H.5

Sub-programme	1979 Estimate				1980 Preliminary estimate			
	P	Man-years		Costs	P	Man-years		Costs
		GS	M&O			GS	M&O	
Food and agriculture								
Soil fertility, irrigation and crop production	2.2	2.6	2.9	310 000	2.5	3.0	3.0	260 000
Plant breeding and genetics	2.2	2.4	2.9	260 000	2.5	2.8	3.2	283 000
Insect and pest control	4.1	6.5	5.5	490 000	4.5	6.7	6.0	530 000
Chemical residues and pollution	0.5	0.5	0.3	70 000	0.5	0.5	0.3	70 000
Sub-total	9.0	12.0	11.6	1 130 000	10.0	13.0	12.5	1 143 000
Life sciences								
Medical applications	2.3	6.7	1.3	510 000	2.3	6.7	2.3	505 000
Dosimetry for intentional radiation exposures ^{a/}	-	-	-	78 000	-	-	-	280 000
Sub-total	2.3	6.7	1.3	588 000	2.3	6.7	2.3	785 000
Physical sciences								
Industrial applications and chemistry	8.0	16.9	6.1	1 306 000	8.0	17.9	6.5	1 400 000
Isotope hydrology	4.4	11.6	0.5	530 000	4.4	11.6	0.7	560 000
Sub-total	12.4	28.5	6.6	1 836 000	12.4	29.5	7.2	1 960 000
Safeguards	5.3	12.8	4.5	840 000	5.3	12.8	5.0	880 000
TOTAL	29.0	60.0	24.0	4 394 000	30.0	62.0	27.0	4 768 000

^{a/} Staff included in Life sciences programme.

SUB-PROGRAMMES

Metrology

OBJECTIVE

H.11. The objective is to serve Member States and other units within the Agency through the calibration of radionuclides, the supply of standard radioactive sources and the comparison and development of nuclear spectroscopy methods.

STRUCTURE

H.12. This sub-programme consists of two components, which are described in the following paragraphs.

Provision of radionuclide intercomparison and nuclear spectroscopy services

Objective

H.13. The objective is to assist laboratories in Member States with radionuclide calibrations (1974-continuing) and to help laboratories in Member States in comparing the results obtained using different spectrum evaluation computer codes and in choosing such codes (1975-continuing).

Results to date

H.14. Over ninety calibrated solutions of 24 different gamma-emitting radionuclides received from institutes in ten Member States have been measured by ionization chambers at the Laboratory; for nearly all of these radionuclides, the Laboratory has performed absolute calibrations, thus making interlaboratory comparisons possible. Updated tables of results have been sent regularly to the ten participating institutes.

H.15. All samples containing known radionuclide activities required for the Analytical Quality Control Service (see the "Chemistry" sub-programme) have been prepared by the Metrology Section.

H.16. Semi-experimental Ge(Li) gamma spectra were prepared in 1976 in computer-compatible formats and sent to about 200 laboratories in Member States, which have since submitted the results of their spectrum evaluations; a comprehensive report is being prepared.

Plans for 1979-80

H.17. The provision of a radionuclide intercomparison service will continue at about the present level (21 participating laboratories) but will be extended to cover pure beta emitters and electron-capturing radionuclides (for example, iron-55). Work for the Analytical Quality Control Service will continue.

H.18. Nuclear spectroscopic intercomparison services covering germanium X-ray spectra and silicon beta spectra will be provided in collaboration with the International Committee on Radionuclide Measurements for about forty institutes in Member States. A high-precision Ge(Li) gamma-ray intercomparison is also planned.

Assistance to the Department of Safeguards

Objective

H. 19. The objective is to develop spectrometric and other methods for safeguards purposes and to prepare special radioactive calibration sources (1962-continuing).

Results to date

H. 20. Gamma-spectrometric methods for determining ratios of plutonium isotopes in large samples have been developed. Alpha-spectrometric methods have also been developed for this purpose and are now being used in the Safeguards Analytical Laboratory.

Plans for 1979-80

H. 21. Calibration sources of types not readily available elsewhere will be developed for use under the "Safeguards development and technical support" sub-programme in studies of the feasibility of determining burn-up in fuel elements stored in cooling ponds.

Chemistry

OBJECTIVE

H. 22. The objective is to advise and assist Member States, other units within the Agency and other United Nations organizations in matters relating to chemistry, particularly analytical chemistry.

STRUCTURE

H. 23. This sub-programme consists of three components, which are described in the following paragraphs.

Analytical quality control

Objective

H. 24. The objective is to assist - by providing analytical quality control samples - laboratories in Member States to achieve and maintain, both in various areas of nuclear science and technology and in areas of general interest where nuclear-based methods can be used to advantage, a high level of reliability in analytical chemistry and verify the reliability level achieved (1964-continuing).

Results to date

H. 25. During the period 1972-77, analytical intercomparisons were organized at a rate of between six and ten a year, with an average of 30 laboratories participating in each intercomparison. In addition, standard and reference samples were supplied to check the validity of analytical procedures used in uranium prospecting, nuclear and isotopic measurements, reactor technology, safeguards, waste disposal and environmental isotope work, geology and hydrology. Altogether, this involved the shipment of several thousand standard, reference and intercomparison samples to over four hundred laboratories in 52 Member States (in 1977, some 390 standard or reference samples and 350 intercomparison samples were shipped). The results of intercomparisons were published in internal reports and scientific journals and presented at technical and scientific meetings.

H. 26. Towards the end of this period, the emphasis shifted to geological materials and environmental pollutants, work on forensic materials being phased out.

Plans for 1979-80

H. 27. The number of intercomparisons will be slightly reduced in order to permit the production of more standard and reference materials. The production of materials which become available from other suppliers (national or international) in sufficient quantity and adequate quality will be reduced or phased out. The production of geological and safeguards materials is expected to increase.

Plans for 1981-84

H. 28. The production of materials will continue to be adjusted to the demand situation; the production of certain materials will be phased out if reliable sources become established. It may be necessary to convene a group of experts during this period to advise on which materials are most useful and should be made available.

Co-operation with other organizations

H. 29. Contacts have been established with WMO, WHO, FAO, UNEP, the International Bureau of Weights and Measures, the Reference Materials Commission of ISO, IUPAC, the International Organization of Legal Metrology, the International Working Group on Geological Reference Materials and national laboratories engaged in the production of standard materials.

Support in analytical chemistry to Member States, other units within the Agency and other United Nations organizations

Objective

H. 30. The objective is to provide support in analytical chemistry to Member States, other units within the Agency and other United Nations organizations, particularly in connection with technical assistance projects (1962-continuing).

Results to date

H. 31. During the period 1972-77, some 3500 samples from 27 Member States were submitted for analysis. Most of them were rock and ore samples collected in the course of uranium prospecting (in connection with technical assistance projects in 15 developing countries); some were analysed in support of two training courses on geochemical prospecting and some in a pre-operational survey for the Safeguards Analytical Laboratory. A total of 7000 individual determinations were involved (in 1977, analytical services involving some 1200 analyses of about 900 samples were provided, mainly in connection with technical assistance projects in the field of uranium prospecting; in addition, some 2500 analyses of about 1100 samples were performed in support of a training course on geochemical prospecting for uranium).

H. 32. A method was developed for the pre-concentration of uranium present in ppb (parts per billion) concentrations in natural water prior to a determination of the uranium-238/uranium-234 ratio by alpha spectrometry. For the measurement of plutonium-239 in environmental samples, a technique using plutonium-236 as tracer was developed. For geochemical samples containing sub-ppm concentrations of uranium, a rapid fluorimetric technique was introduced.

H. 33. Numerous homogeneity tests were carried out, using neutron activation analysis and X-ray fluorescence analyses, on intercomparison samples prepared at Monaco and at Seibersdorf.

H. 34. Considerable time was spent on the formal and the on-the-job training of scientists from Member States. Three missions were undertaken to advise Member States on laboratory techniques and equipment.

H. 35. Nine fellows from eight Member States received on-the-job training in special aspects of low-level radiochemical analysis and three training courses were supported through lectures, experiments and the analysis of samples.

Plans for 1979-80

H. 36. The amount of work done on geological samples will depend on the demand. The number of analyses in support of uranium exploration projects is expected to increase.

H. 37. It is expected that 500-1000 samples a year will have to be analysed in support of uranium prospecting associated with technical assistance projects in 15-20 countries.

H. 38. In 1979, the holding of a further training course on geochemical prospecting for uranium will involve the analysis of an extra 1000 samples. On-the-job training will continue in response to the demand.

Plans for 1981-84

H. 39. A further increase in the demand for determinations of uranium in geochemical and prospecting samples is expected. Training and support for training courses will continue.

Support in chemistry to the Agriculture Section of the Laboratory

Objective

H. 40. The objective is to provide support in chemistry to the Agriculture Section, specifically in mass and emission spectroscopy and analytical chemistry (1962-continuing).

Results to date

H. 41. The Chemistry Section has carried out mass- and emission-spectrographic determinations of nitrogen-15 in agricultural samples, the Agriculture Section being responsible for the routine operation of the spectrometers. Advice and assistance with analytical chemistry (for example, neutron activation analysis and the analysis of amino acids) have been provided as required.

Plans for 1979-84

H. 42. Assistance lying within the competence of the Chemistry Section will be provided as required.

Isotope hydrology

STRUCTURE

H. 43. This sub-programme consists of two components, which are described in the following paragraphs.

Analytical services

Objective

H. 44. The objective is to provide analytical services in support of the "Isotope hydrology" sub-programme of the "Physical Sciences" programme.

Results to date

H. 45. During the period 1972-77, about 9000 oxygen-18 and carbon-13 analyses, 6500 deuterium analyses, 7000 tritium analyses and 250 carbon-14 analyses were performed for the Agency/WMO "Isotopes in Precipitation" survey and for field projects in Member States. Since March 1977, about 300 chemical analyses of natural waters have been performed as a complement to isotopic analyses.

H. 46. Several Member States have received help in setting up their own analytical facilities - advice on equipment, testing and calibration of equipment after installation and training of scientists and technicians in the use of equipment.

Plans for 1979-84

H. 47. The main activity will continue to be the determination of the environmental isotope and chemical composition of natural waters. Measurement techniques will continue to be developed and up-dated and the degree of automation will be increased.

H. 48. A consultants' meeting to discuss recent technical developments in work on determining tritium, carbon-14 and other radioactive environmental isotopes is planned for 1980.

H. 49. The activities of the Isotope Hydrology Laboratory, which is housed in the Agency's temporary headquarters, will continue, but they may be temporarily affected during the move to the Donaupark.

Related activities

H. 50. It is expected that technical assistance projects involving the installation of laboratories in Jordan and Turkey will be completed by 1980.

Preparation and distribution of standards and intercalibration of measurements

Objective

H. 51. The objective is to prepare standards for the intercalibration of measurements and distribute them among laboratories working in isotope hydrology and geochemistry.

Results to date

H. 52. Standard water samples with known stable-isotope composition are being distributed by the Isotope Hydrology Laboratory. A consultants' meeting on stable-isotope standards and intercalibration in hydrology and geochemistry, held in 1976, discussed the results of an intercalibration organized by the Isotope Hydrology Laboratory in which 45 laboratories took part and formulated guidelines for future intercalibrations (one now under way) and for the establishment of new stable-isotope standards.

H. 53. An intercalibration of measurements of tritium at the environmental level, in which 41 laboratories participated, has also been organized by the Isotope Hydrology Laboratory.

Plans for 1979-84

H. 54. Standard water samples with known stable-isotope composition will continue to be distributed, including samples conforming to the standards established in accordance with the recommendations made at the above-mentioned consultants' meeting. The results of the current intercalibration will be evaluated.

Agriculture

STRUCTURE

H. 55. This sub-programme consists of four components, which are described in the following paragraphs.

Services to the "Soil fertility, irrigation and crop production" sub-programme of the "Food and Agriculture" programme

Objective

H. 56. The objective is to provide training in and perform routine isotopic analyses (1962-continuing), prepare and distribute labelled fertilizers (1962-continuing), carry out preliminary greenhouse and field studies (1962-continuing) and develop techniques for the determination of dinitrogen fixation in the field for co-ordinated research programmes (1977-80).

Results to date

H. 57. Analytical services have been provided and techniques developed for studies of the efficiency of fertilizer (particularly nitrogen and phosphorus) utilization by rice, wheat and legumes. About 15 000 samples a year have been analysed using various analytical procedures.

H. 58. A method for determining symbiotic dinitrogen fixation by legume crops in the field has been developed within the framework of a co-ordinated research programme; a further co-ordinated research programme, on biological dinitrogen fixation, has been initiated.

Plans for 1979-84

H. 59. A wider range of plant-rearing conditions will become available following the erection of a new greenhouse donated by the Government of the United States.

H. 60. Increased emphasis will be placed on training fellows from developing countries. The services hitherto provided to participants in co-ordinated research programmes will continue if requested and if resources permit.

Services to the "Plant breeding and genetics" sub-programme of the "Food and Agriculture" programme

Objective

H. 61. The objective is to provide seed and plant material irradiation services for co-ordinated research programmes (1965-continuing), develop methods for and provide training in mutation induction (1965-continuing), carry out routine screening of crops for mutants with improved and/or increased grain protein (1970-81) and develop routine screening methods for the identification of mutants with changed chemical composition and/or resistance (1978-84).

Results to date

H. 62. Considerable emphasis has been placed on the development of analytical methods for the selection of protein mutants of wheat, barley, rice and millet. Total protein and the amounts of certain amino acids in seed material are being determined at a rate of 800 samples per day by means of semi-automatic and fully automatic methods.

H. 63. Methodological studies of the efficiency of the induction of mutational changes for protein improvement in wheat have led to the conclusion that such mutational changes occur with an appreciably lower frequency than in diploid cereal species (for example, in barley or rice).

H. 64. In view of the increasing world-wide interest in grain legume improvement, investigations of the response of legume seed species to various mutagens have been initiated; suitable dose ranges determined for certain species have been announced in the Mutation Breeding Newsletter.

Plans for 1979-80

H. 65. The provision of seed irradiation and analytical services, the development of analytical procedures and the provision of training in the field of seed protein improvement will continue, but there will be gradually more emphasis on mutagenesis in leguminous crops.

H. 66. Research will be carried out and services and training provided in connection with the screening of mutants (grown in a greenhouse) for increased resistance to stress factors and/or changed chemical composition.

Plans for 1981-84

H. 67. Increased emphasis will be placed on the provision of services and training in areas of special interest for plant breeding in developing countries.

Services to the "Insect and pest control" sub-programme of the "Food and Agriculture" programme

Objective

H. 68. The objective is to develop techniques for and provide training in the mass-rearing of the Mediterranean fruit fly, the olive fly and other plant-feeding insects (1968-81) and of the tsetse fly (1970-85), to develop tracer methods for such purposes as the study of insect ecology (1978-83), to study - with the help of tracer methods - insect ecology (host plant succession, interactions between insects and host plants, etc.) and to develop - with the help of isotope techniques - more predictable and effective insecticide application methods (1978-84).

Results to date

H. 69. The development of mass-rearing methods for Mediterranean fruit flies (medflies), olive flies and tsetse flies has continued, the emphasis being on the rearing of tsetse flies on artificial-feeding membranes with animal blood as food; the tsetse fly species Glossina morsitans and Glossina palpalis are now being reared without living animals as a source of blood. The membranes developed at the Laboratory are being supplied for experimental use to Member States.

H. 70. A one-year agreement has been concluded with the Mexican Government and USDA-APHIS (the Animal and Plant Health Inspection Service of USDA) for the large-scale use of the sterile-insect technique in the control and/or eradication of the medfly in the northern part of Central America; under the agreement, the Agency is supplying (on a cost-reimbursable basis) 35 million irradiated medfly pupae a week.

Plans for 1979-84

H. 71. The results of the mass-rearing technology development work which has been done at the Laboratory will be handed over to establishments in Member States, especially to the

large mass-rearing facility which is under construction in Mexico and which is expected to play a leading role in the application of the sterile-insect technique and in the provision of training.

H.72. The development of techniques for and the provision of training in the mass-rearing of tsetse flies (and other insects) will continue in support of ongoing field programmes.

H.73. Methods will be developed for comparing the quality (flight ability, vision, mating ability, etc.) of mass-reared and wild insects; training will also be provided.

H.74. Tracer methods will be developed for and used in insect ecology studies.

Services to the "Chemical residues and pollution" sub-programme of the "Food and Agriculture" programme

Objective

H.75. The objective is to carry out routine isotopic analyses of plant and soil samples deriving from co-ordinated research programmes (1974-80).

Results to date

H.76. Investigations of fertilizer nitrogen movement, as a function of soil type and rainfall, in the root zone of maize and sugar beets have been carried out under a co-ordinated research programme on agricultural nitrogen residues, and injection techniques for use in studying active root development have been developed. Experiments with slow-release urea fertilizers have shown that the rate of initial fertilizer transformation in soils can be controlled.

Plans for 1979-84

H.77. Studies of the effects of agricultural practices on the fate of fertilizer nitrogen in soil will be carried out until 1980 in support of the co-ordinated research programme on agricultural nitrogen residues, with an expected annual analytical work load of 2000-3000 samples. Field techniques for measuring nitrogen losses due to denitrification will be developed and applied.

Safeguards Analytical Laboratory (SAL)

STRUCTURE

H.78. This sub-programme consists of two components, which are described in the following paragraphs.

Analytical and other support for safeguards activities

Objective

H.79. The objective is to carry out chemical and isotopic analyses of safeguards samples and provide training in analytical techniques; to participate in safeguards analytical quality control work; to assist in the characterization of safeguards physical standards and in the modification, maintenance and calibration of non-destructive assay and other inspection equipment; and to assist in the training of safeguards inspectors.

Results to date

H. 80. The Safeguards Analytical Laboratory (SAL) has been operating under an Austrian "type B" licence since February 1976; it is expected that a full operating licence will be issued this year. Equipment (including the first mass spectrometer) previously in the Chemistry Section of the Agency's Laboratory was installed together with new equipment in SAL by November 1976. A second mass spectrometer, specially designed at Oak Ridge National Laboratory for the analysis of nanogram samples, has been in operation since September 1976 and is being tested for its suitability for analysing spent fuel samples (the first spent fuel samples taken during inspection were received towards the end of 1977). An automatic titrator for uranium is undergoing tests.

H. 81. The analysis of safeguards samples has remained the principal activity in support of safeguards, but assistance with non-destructive assay work and the development of surveillance techniques has also been given.

Plans for 1979-80

H. 82. SAL, which can handle 1300-2000 samples a year (for example, a combination of 600 uranium samples, 150 plutonium samples, 150 uranium-plutonium samples and 400 spent fuel samples would constitute a full work load), will operate from 1979 onwards at a level dependent on the safeguards inspection programme. The "resin bead" technique for the analysis of minute samples of spent fuel will be tested, the aim being to achieve a situation where spent fuel samples can be shipped as exempted radioactive materials. Assistance in fields other than destructive analysis - for example, the evaluation of the results of analyses of inspection samples and reference materials, support for the work on neutron track etch monitors, support for surveillance camera activities, non-destructive assay equipment testing and calibrating and assistance to inspectors on request - will be further expanded.

Plans for 1981-84

H. 83. It is expected that during this period the point will be reached where optimum use is being made of SAL's capacity in different fields, direct support for safeguards and other Agency activities accounting for 80-90% and the maintenance of analytical equipment and the development and improvement of techniques accounting for 10-20% of the staff's time.

Analytical services in support of other Agency activities

Objective

H. 84. The objective is to assist - to the extent that SAL's manpower is not being utilized for safeguards work - with activities under the "Analytical quality control" component of the Laboratory's "Chemistry" sub-programme and provide analytical services to other units within the Agency.

Results to date

H. 85. In 1977, trace elements in biological samples were determined in support of activities being carried out under the "Life Sciences" programme.

Plans for 1979-84

H. 86. SAL will support work being done under the "Life Sciences" programme on the determination of trace elements in biological and environmental materials, using chemical methods to check on the results of non-destructive determinations performed at laboratories in Member States.

H. 87. Other Agency activities - including the provision of training - will be supported to the extent that SAL's manpower is not being utilized for safeguards work and the necessary apparatus and techniques are available.

Electronics and workshop services

OBJECTIVE

H. 88. The objective is to provide electronics and workshop services as required.

RESULTS TO DATE

H. 89. The work of the Electronics Section consists in servicing and maintaining electronic equipment and constructing equipment for special needs if such equipment is not commercially available.

H. 90. In 1977, apart from the construction of surveillance equipment for use in the "Safeguards" programme, considerable work was done in support of the "Life Sciences" programme, with which arrangements have been made for co-operation in the construction of prototypes of automatic equipment which is easy to use and service, relatively inexpensive and hence suited to the needs of developing countries; two models of an electronic control unit for an automatic scintillation counter were built in 1977.

PLANS FOR 1979-84

H. 91. In addition to meeting the needs of the Agency's Laboratory, the Electronics Section will continue building prototypes of equipment suitable for use in developing countries; for this purpose, modern electronic techniques (such as large-scale integration) involving the use of microprocessors will be employed. If funds are available, work on the development of microprocessor applications will be expanded with a view to greater efficiency in the construction of process control and other equipment.

H. 92. Special items of equipment will continue to be built on request.

I. INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table I.1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	262 619	300 000	26 000	-	26 000	326 000	371 000
Consultants	12 554	20 000	1 000	6 000	7 000	27 000	27 000
Overtime	6 625	8 000	1 500	1 500	3 000	11 000	11 000
Temporary assistance	24 908	18 000	3 000	11 000	14 000	32 000	32 000
Sub-total	306 706	346 000	31 500	18 500	50 000	396 000	441 000
Common staff costs	68 299	90 000	1 000	-	1 000	91 000	98 500
Travel	8 826	5 000	500	3 500	4 000	9 000	10 000
Meetings							
Conferences, symposia, seminars	581 949	414 000	83 000	(1 000)	82 000	496 000	428 000
Technical committees, advisory groups	4 575	7 500	-	(1 000)	(1 000)	6 500	7 500
Representation and hospitality	9 211	6 500	1 000	500	1 500	8 000	8 500
Common services, supplies and equipment	211 442	220 000	33 000	8 000	41 000	261 000	276 000
Other items of expenditure							
Fellowships	-	6 000	-	(6 000)	(6 000)	-	-
Visiting scientists and lecturers	134 503	200 000	40 000	20 000	60 000	260 000	260 000
Associate members and federated institutions	144 421	200 000	30 000	(52 000)	(22 000)	178 000	176 000
Other	3 039	-	-	9 500	9 500	9 500	9 500
Sub-total	281 963	406 000	70 000	(28 500)	41 500	447 500	445 500
Transfer of costs:							
Printing and publishing services	114 024	150 000	10 000	-	10 000	160 000	200 000
TOTAL	1 586 995	1 645 000	230 000	-	230 000	1 875 000	1 915 000
<u>Source of funds:</u>							
Regular Budget	564 024	600 000	60 000	50 000	110 000	710 000	750 000
Operating Fund I	1 022 971	1 045 000	170 000	(50 000)	120 000	1 165 000	1 165 000
TOTAL	1 586 995	1 645 000	230 000	-	230 000	1 875 000	1 915 000

SUMMARY OF MANPOWER

Table I.2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
P-5	1	1	1	-	1	1
P-4	1	1	2	-	2	2
P-3	3	3	2	-	2	2
Sub-total	5	5	5	-	5	5
GS	17	17	17	-	17	19
TOTAL	22	22	22	-	22	24

CHANGES IN COSTS AND MANPOWER

Costs

I.1. As will be seen in Table I.1 above, the total cost of this programme is expected to increase by \$230 000 in 1979 as a result of salary and other price increases.

I.2. Programme increases of \$30 500 in respect of consultants' services, overtime and temporary assistance, travel, hospitality and common services, supplies and equipment are offset by programme reductions of \$2000 in respect of meetings and \$28 500 in respect of scientific activities.

I.3. It is expected that the activities of the Centre will be financed in 1979 from the following sources:

Regular Budget:

Basic contribution	550 000	
Contribution to meet publishing costs	160 000	710 000
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Operational Budget:

Italian Government	700 000	
UNESCO	310 000	
SIDA	80 000	
Other	75 000	1 165 000
	<hr/>	<hr/>
		1 875 000
		<hr/>

Manpower

I.4. No additional manpower is foreseen for 1979.

I.5. For 1980, two additional GS posts will be required for coping with the heavier administrative work load resulting from an increase in scientific activities.

THE PROGRAMME

OBJECTIVE

I.6. The objective is to foster, through research and training for research, the advancement of theoretical physics with special regard to the needs of developing countries so as to encourage theoretical physicists from those countries to continue and expand their research work.

CO-OPERATION WITH OTHER ORGANIZATIONS

I.7. The Centre is operated jointly by the Agency and UNESCO and is supported by the Italian Government; SIDA also participates in its financing. UNDP has financed projects in the physics of oceans and the atmosphere, in applied mathematics and computer science, and in solid state physics, with UNESCO as executing agency. While it is at present not certain whether UNDP will be able to continue its support, discussions are still in progress.

It is expected that other United Nations specialized agencies will co-operate in areas within their spheres of interest.

RELATED ACTIVITIES

I. 8. As a follow-up to activities at the Centre, and in order to give more researchers from developing countries an opportunity to discuss problems in their own environment, support has been given to a number of meetings in developing countries, the main ones being the conferences on physics and contemporary needs held in Pakistan in 1976 and 1977; these conferences were supported largely by the Government of Pakistan (the one held in 1976 also received considerable support from SIDA) and were attended by 114 and 107 scientists respectively. The intention is to continue providing support for selected meetings in developing countries.

STRUCTURE

I. 9. This programme - formulated with the help of the Centre's Scientific Council, which will meet in 1979 (Advisory Group - Annex II (94) and in 1980 (Advisory Group) - consists of six sub-programmes, which are dealt with separately below.

SUB - PROGRAMMES

Physics and technology

OBJECTIVE

I. 10. The objective is to foster fundamental research and training for fundamental research in condensed matter physics and in atomic, molecular and laser physics in developing countries, with emphasis on aspects leading to applications in industrial and technological development.

STRUCTURE

I. 11. This sub-programme consists of two components, which are described in the following paragraphs.

Condensed matter physics (including semiconductor devices, superconductors, surface phenomena and modern materials)

Results to date

I. 12. This component was initiated in 1967. Extended courses were held in 1967, 1970, 1972, 1974 and 1977 and workshops lasting three to four months were organized every year from 1970 to 1977; topical meetings were held in various years within the framework of the workshops. A course on the physics of modern materials has been planned for 1978. To date, about 1000 scientists have participated in these activities. Approximately 205 pre-prints and the proceedings of the extended courses have been published.

Plans for 1979-80

I. 13. It is planned to organize a solid state workshop in 1979 (Seminar - Annex I (22)) and a solid state winter college followed by a workshop in 1980.

Plans for 1981-84

I. 14. It is planned to organize further workshops in condensed matter physics in 1981 and 1983 and an extended course followed by a workshop in each of the years 1982 and 1984.

Atomic, molecular and laser physics

Results to date

I.15. The Centre has organized two winter colleges on atoms, molecules and lasers (in 1973 and in 1977); they were attended by a total of 198 lecturers and other participants. The proceedings of the 1973 winter college have been published.

Plans for 1979-80

I.16. Questions of atomic and laser physics will be discussed at a winter college (Seminar - Annex I (17)).

Plans for 1981-84

I.17. An extended course will be organized in 1981. A workshop is planned for 1982.

Physics and the frontiers of knowledge

OBJECTIVE

I.18. The objective is to provide a forum for international collaboration at the highest possible level in the most advanced research in fundamental theoretical physics and to enable university teachers from developing countries, through participation in meetings held at the Centre, to bring their knowledge up to date and exchange ideas concerning their research work.

STRUCTURE

I.19. This sub-programme consists of two components, which are described in the following paragraphs.

High-energy and particle physics

Results to date

I.20. This component was initiated in 1964. One extended seminar was held in 1965, while part of the Symposium on Contemporary Physics - in 1968 - covered high-energy and particle physics. Two topical meetings were held in 1969, two in 1970, two in 1971, one in 1973, two in 1974, one in 1975, four in 1976 and two in 1977. Research in high-energy physics has been carried out at the Centre since its establishment. About 2500 physicists have participated in this part of the programme as visiting or guest scientists, associate members, fellows, guest lecturers and seminar participants. Approximately 965 preprints and the proceedings of the seminar held in 1965 and of various other meetings have been published.

Plans for 1979-84

I.21. A topical meeting on high-energy physics will be held in 1979 (Seminar - Annex I (21)). Research will continue, and one or more further meetings relating to current developments will be held if the need arises.

Relativity, cosmology and astrophysics

Results to date

I.22. Many astrophysicists attended the Symposium on Contemporary Physics at which 13 survey papers by leading scientists were presented. Conferences on late-type stars (1965), mass loss from stars (1968) and supergiant stars (1971), organized by the University

of Trieste and held on the Centre's premises, gave physicists present at the Centre at the time a chance to familiarize themselves with the problems of astrophysics; about 300 physicists attended these conferences. A research session on astrophysics and relativity was organized in July-August 1973, with 63 scientists taking part and 13 preprints being published. A workshop on compact X-ray sources was organized in 1974. A meeting on recent developments in the fundamentals of general relativity was held in 1975 and one on physics and astrophysics aspects of the Spacelab programme in 1976; total participation in these two meetings was 208.

Plans for 1979-84

I.23. A further one in the series of Marcel Grossmann meetings will be held in 1979 (Seminar - Annex I (25)). It is planned to organize summer research sessions and also topical meetings, possibly every year. The size of the research groups will depend on the resources available.

Applicable mathematics and planning models

OBJECTIVE

I.24. The objective is to acquaint scientists with applications of and new methods for using mathematical tools in the various disciplines in which activities are conducted at the Centre through, for example, projects financed by UNDP and executed by UNESCO.

STRUCTURE

I.25. This sub-programme consists of two components, which are described in the following paragraphs.

Fluid dynamics and other branches of applicable mathematics

Results to date

I.26. Extended seminars on fluid dynamics and its applications to other branches of science were held in 1973 and in 1976, with some 240 scientists taking part. An extended course on applications of global analysis was held in 1972 (with a total of 274 lecturers and other participants) and one on applications of complex analysis was held in 1975 (with a total of 116 lecturers and other participants). From 28 November to 16 December 1977, the Centre hosted a workshop on problems of boundary values for ordinary differential equations and of their applications (with some 100 participants). Various topical meetings were organized within the framework of the extended seminars.

Plans for 1979-80

I.27. There are plans for a workshop on applicable mathematics in 1979 (Seminar - Annex I (24)) and an extended course in 1980.

Systems analysis, computing and the mathematics of development

Results to date

I.28. The first endeavour of the Centre in this field was an extended seminar on computing as a language of physics, held in 1971 and attended by 244 scientists. A second extended seminar, held in 1974 and devoted to control theory and topics in functional analysis, was attended by 96 lecturers and other participants. A course on systems analysis and one on mathematics, economics and development have been planned for 1978.

Plans for 1979-84

I. 29. It is planned to organize extended seminars or workshops every year provided that funds are available.

Physics and energy

OBJECTIVE

I. 30. The objective is to foster research and training for research in theoretical nuclear physics and nuclear reactor theory and in the physics of nuclear fusion and of renewable energy sources such as solar energy, with particular regard to the needs of developing countries.

STRUCTURE

I. 31. This sub-programme consists of three components, which are described in the following paragraphs.

Nuclear physics

Results to date

I. 32. This component was initiated in 1964 with a small research group and continued in 1965. Extended courses were organized in 1966, 1969, 1971 and 1973. A larger research group was active from 1966 to 1968. Workshops were organized in 1969, 1971, 1975 and 1976 and topical meetings in 1975 and 1976. In the years when there was no formal programme of work in nuclear physics, some research was carried out by associate members, independently or in collaboration with scientific staff of the University of Trieste. Some 1070 scientists have participated in these activities. A course and workshops on nuclear theory and nuclear reactors have been planned for 1978. Proceedings of the extended courses and of the topical meeting held in 1975 have been published.

Plans for 1979-80

I. 33. An extended seminar on nuclear physics will be held in 1980.

Plans for 1981-84

I. 34. It is planned to organize an extended course or a workshop in 1981 and in 1983.

Plasma physics and nuclear fusion

Results to date

I. 35. This component was initiated in 1964 and an extended course was held in that year. A small working party worked at the Centre through the period 1964-65, and its membership was increased in 1965-66. Research sessions were organized in 1970 and 1973 and a topical meeting in 1975. In 1977, the Centre organized a three-week seminar on theoretical and computational plasma physics, during which the Third International (Kiev) Conference on Plasma Theory was held, and hosted a meeting of the International Fusion Research Council.

I. 36. Approximately 450 scientists have participated in these activities. About sixty-five preprints and the proceedings of the extended course held in 1964 have been published. Excellent collaboration between participating plasma physicists has characterized the research sessions.

Plans for 1979-80

I. 37. An extended course on plasma physics will be organized in 1979 (Seminar - Annex I (18)) and a workshop in 1980.

Plans for 1981-84

I. 38. Research workshops will be organized in 1982 and 1984 and an extended course in 1983.

Solar energy and other energy sources

Results to date

I. 39. In 1977 the Centre organized, in collaboration with the International College of Applied Physics, a three-week course on solar energy conversion; it was attended by 203 lecturers and other participants.

Plans for 1979-84

I. 40. It is planned to organize a summer college on solar energy in 1979 (Seminar - Annex I (19)) and workshops on subjects falling within this component every year.

Physics of natural resources and the environment

OBJECTIVE

I. 41. The objective is to foster, in developing countries, research and training for research (both fundamental and applied) in fields relating to natural resources, with emphasis on their preservation and on pollution problems, and to bring the specialized knowledge and skills of physicists, mathematicians and biologists to bear on particular problems.

STRUCTURE

I. 42. This sub-programme consists of two components, which are described in the following paragraphs.

Physics of oceans, the atmosphere and the earth

Results to date

I. 43. The Centre organized a three-month course on the physics of oceans and the atmosphere in 1975; it was attended by 123 scientists. A ten-week course on the physics of the earth, including an advisory meeting and a seminar on earthquake prediction, was held in 1977, with the participation of some 110 scientists.

Plans for 1979-84

I. 44. An autumn course on the geophysics and physics of the desert will be organized in 1979 (Seminar - Annex I (20)) and a course on the physics of the environment and of natural resources in 1980. Further courses will be held during the period 1981-84, possibly with the co-operation of other international organizations.

Biophysics

Results to date

I. 45. Part of the Symposium on Contemporary Physics was devoted to biophysics. In 1972, during the Summer College on Global Analysis and its Applications, a small group of

physicists, biologists and physicians met for three days to discuss neural networks. A summer school on the physics and mathematics of the nervous system, sponsored partly by the Volkswagen Foundation and attended by 89 scientists, was held in August 1973.

Plans for 1979-84

I.46. Subject to the availability of funds, small meetings will be held in some years during this period.

Science teaching

OBJECTIVE

I.47. The objective is - under UNESCO's auspices - to impart to scientists with teaching duties in developing countries modern teaching methods which take local social, economic and cultural conditions into account, thereby promoting and improving the teaching of science at all levels, particularly in Member States where scientific communities are still very small.

RESULTS TO DATE

I.48. A workshop was organized in 1976 for scientists from English-speaking developing countries and one in 1977 for scientists from French-speaking developing countries; the number of participants was 50 and 83 respectively.

PLANS FOR 1979-80

I.49. A college on physics teaching to be held in French is planned for 1979 (Seminar - Annex I (23)) and a workshop on physics teaching to be held in English is planned for 1980.

PLANS FOR 1981-84

I.50. It is planned to hold workshops and seminars every year during this period.

J. INTERNATIONAL LABORATORY OF
MARINE RADIOACTIVITY

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table J. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	434 597	478 000	27 000	-	27 000	505 000	565 000
Consultants	3 400	5 400	300	300	600	6 000	6 500
Sub-total	437 997	483 400	27 300	300	27 600	511 000	571 500
Common staff costs	120 092	143 500	(2 100)	-	(2 100)	141 400	154 900
Travel	6 907	8 000	600	400	1 000	9 000	10 000
Representation and hospitality	692	1 600	100	(100)	-	1 600	1 600
Scientific and technical contracts	497	-	-	-	-	-	-
Scientific supplies and equipment	61 189	80 000	8 000	12 000	20 000	100 000	130 000
Common services, supplies and equipment	53 265	35 500	3 500	11 000	14 500	50 000	60 000
Transfer of costs:							
Linguistic services	-	1 000	-	(1 000)	(1 000)	-	-
Printing and publishing services	1 207	3 000	200	(200)	-	3 000	3 000
TOTAL	681 846	756 000	37 600	22 400	60 000	816 000	931 000
Source of funds:							
Regular Budget	578 849	646 000	31 600	18 400	50 000	696 000	799 000
Operating Fund I	102 997	110 000	6 000	4 000	10 000	120 000	132 000
TOTAL	681 846	756 000	37 600	22 400	60 000	816 000	931 000

SUMMARY OF MANPOWER

Table J. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
P-5	3	3	3	-	3	3
P-4	2	2	2	-	2	3
P-3	1	1	1	-	1	1
P-1	2	2	2	-	2	2
Sub-total	8	8	8	-	8	9
GS	15	15	15	-	15	16
TOTAL	23	23	23	-	23	25

CHANGES IN COSTS AND MANPOWER

Costs

J. 1. As will be seen from Table J.1 above, the cost of this programme is expected to increase by \$60 000, of which \$37 600 will be required to cover salary and other price increases and \$22 400 will be a programme increase.

J. 2. Programme increases in respect of consultants' services (\$300) and duty travel (\$400) are offset by programme reductions in respect of hospitality (\$100), linguistic services (\$1000) and printing and publishing services (\$200).

J. 3. A programme increase of \$12 000 is foreseen in respect of scientific supplies and equipment and, in the light of actual requirements in 1977, a programme increase of \$11 000 is foreseen in respect of common services, supplies and equipment.

J. 4. It is expected that the amount available for this programme under the Operational Budget will increase by \$10 000 to \$120 000. In addition to the contribution from the Monegasque Government, it is expected that UNESCO will again contribute under a contractual arrangement and that the balance will be covered by miscellaneous income. It is also expected that UNEP will contribute \$100 000 in support of the International Laboratory's environmental protection activities.

Manpower

J. 5. No additional manpower is foreseen for 1979.

J. 6. For 1980, one additional P-4 post for an expert in alpha radioactivity in the seas and one additional GS post are foreseen.

THE PROGRAMME

OBJECTIVE

J. 7. The objective is to promote the intercomparability of radioactivity measurements made in national laboratories and institutes for marine radioactivity studies, to develop reference analytical methods and techniques for investigating the behaviour of radioactivity in the oceans and to obtain the scientific information needed to assess the impact of waste disposal and nuclear power generation on the environment.

STRUCTURE

J. 8. This programme consists of three sub-programmes, which are dealt with separately below.

Summary of manpower and costs by sub-programme

Table J. 3

Sub-programme	1979 Estimate					1980 Preliminary estimate				
	Man-years		Costs			Man-years		Costs		
	P	GS	Staff	Other	Total	P	GS	Staff	Other	Total
Biology	2.5	5.0	194 400	52 600	247 000	3.0	5.4	225 100	64 900	290 000
Chemistry	2.5	5.0	225 500	58 500	284 000	3.0	5.3	257 200	74 800	332 000
Environmental studies	3.0	5.0	232 500	52 500	285 000	3.0	5.3	244 100	64 900	309 000
TOTAL	8.0	15.0	652 400	163 600	816 000	9.0	16.0	726 400	204 600	931 000

SUB - PROGRAMMES

Biology

OBJECTIVE

J. 9. The objective is to develop and evaluate methods for assessing the importance of biological processes in the transport of radionuclides, trace metals and other selected pollutants in the ocean and to investigate the biological effects of the constituents of reactor cooling waters on aquatic biota by studying the biological transport of selected heavy metals and radionuclides and synergism between metals and chlorinated hydrocarbons as it relates to their accumulation in marine organisms.

RESULTS TO DATE

J. 10. Mathematical models for assessing the role played by zooplankton in transporting radionuclides and trace metals from the ocean surface layers to depth have been developed. For certain elements (for example, transuranic elements, natural alpha-emitters and heavy metals), biological pathways have been shown to be particularly important. Assessments have also been made of the role of sediment-dwelling biota in the marine biogeochemistry of transuranic radionuclides and selected heavy metals. Baseline studies on the trace metal content of oceanic organisms from selected areas of the open Mediterranean have been completed.

PLANS FOR 1979-80

J. 11. Sediment traps will be employed in studying the vertical transport of pollutants, special attention being paid to the in situ collection of biogenic debris; the initial ocean testing of these devices will be completed in 1980. The metabolism of transuranic elements in marine biota will also be investigated.

RELATED ACTIVITIES

J. 12. Subject to continued UNEP support, baseline studies on the trace metal content of open ocean biota from the Mediterranean will continue and the models developed for radionuclide uptake, distribution and transport studies will be applied to chlorinated hydrocarbons and to selected heavy metals which can be studied by means of nuclear techniques.

PLANS FOR 1981-84

J. 13. Laboratory and field work will continue on the behaviour of transuranic elements, metals and other pollutants in marine biota, with emphasis on deep sea species inhabiting potential waste disposal sites.

CO-OPERATION WITH OTHER ORGANIZATIONS

J. 14. Continued co-operation with UNEP and UNESCO is envisaged.

Chemistry

OBJECTIVE

J. 15. The objective is to develop and verify reference analytical methods for the determination of radionuclides and heavy metals in marine samples - through the continuing preparation and distribution of different marine materials containing various levels of contaminants, the UNEP-supported intercalibration programme for heavy metals in the Mediterranean (to be extended to 1979) and studies of the biogeochemical behaviour of transuranic elements in the marine environment - with a view to gaining the necessary scientific knowledge of processes affecting the disposal of radioactive wastes in the deep sea.

RESULTS TO DATE

J. 16. Many reference samples have been analysed by laboratories in a number of Member States and considerable improvements in their results have been noted during repeated intercalibration exercises. However, standardization and data analysis difficulties continue to pose serious problems for the budgeting of radioactivity in the world's oceans.

PLANS FOR 1979-80

J. 17. The review of intercalibration results for radioactivity measurements will be completed during 1978. However, work will continue on the development and verification of reference methods of analysis, as will fundamental work relating to biogeochemical studies of transuranic elements. The intercalibration of measurements of trace metals in marine samples (supported by UNEP) will be extended to other regions.

RELATED ACTIVITIES

J. 18. New techniques for the measurement of various trace elements in sea-water and marine biological materials by anodic stripping voltametry and atomic absorption spectroscopy will be explored.

PLANS FOR 1981-84

J. 19. Work will continue on transuranic biogeochemistry and trace metal measurement techniques. Fundamental studies of radionuclide and trace metal behaviour in deep ocean waters as it relates to the disposal of radioactive wastes at sea will be carried out.

CO-OPERATION WITH OTHER ORGANIZATIONS

J. 20. Continued co-operation with UNESCO and UNEP in marine pollution studies is envisaged.

Environmental studies

OBJECTIVE

J. 21. The objective is to assess the effects of pollutants on selected living cells and other organisms (1977-80), major pollutants used in the experiments being chlorinated hydrocarbons, heavy elements and radionuclides.

RESULTS TO DATE

J. 22. A study on the formation of chloramines has been completed. Laboratory experiments have been carried out on rates of uptake and loss of various pollutants, mostly chlorinated hydrocarbons, at different concentrations. The ability of such pollutants to be passed along food chains and their lethal effects at different dosages are being studied.

PLANS FOR 1979-80

J. 23. Now that the experimental procedures have been established and initial results are available, the experiments will be modified and intensified so as to assess the effects of the pollutants of interest in marine ecosystems. Tests relating to the mutagenicity of toxic substances will be initiated.

RELATED ACTIVITIES

J. 24. These activities are very closely linked with the work being done under the "Biology" sub-programme, being supervised by a committee with representatives of both sub-programmes so as to ensure maximum co-operation.

PLANS FOR 1981-84

J. 25. Studies of the effects of pollutants on individual organisms, on populations and on ecosystems will be continued. Work on the mutagenic effects of toxic materials at the cellular level will be expanded.

CO-OPERATION WITH OTHER ORGANIZATIONS

J. 26. Continued co-operation with UNEP and UNESCO is envisaged.

K. SAFEGUARDS

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table K. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	3 803 999	5 412 000	349 000	1 779 000	2 128 000	7 540 000	9 255 000
Consultants	32 298	86 000	2 800	(15 800)	(13 000)	73 000	35 500
Overtime	1 100	2 500	100	1 700	1 800	4 300	5 200
Temporary assistance	8 746	2 200	100	200	300	2 500	8 000
Sub-total	3 846 143	5 502 700	352 000	1 765 100	2 117 100	7 619 800	9 303 700
Common staff costs	1 051 171	1 569 600	43 600	495 600	539 200	2 108 800	2 544 700
Travel	612 003	693 000	48 700	110 300	159 000	852 000	1 101 500
Meetings							
Conferences, symposia, seminars	21 244	141 000	5 000	(61 000)	(56 000)	85 000	88 000
Technical committees, advisory groups	145 415	130 000	5 000	66 000	71 000	201 000	216 400
Representation and hospitality	10 291	12 700	700	-	700	13 400	15 700
Scientific and technical contracts	141 378	420 000	21 000	94 000	115 000	535 000	785 000
Scientific supplies and equipment	817 204	814 000	57 000	-	57 000	871 000	913 000
Common services, supplies and equipment	67 410	-	-	-	-	-	-
Transfer of costs:							
Linguistic services	75 233	140 000	8 000	6 000	14 000	154 000	166 000
Printing and publishing services	46 120	150 000	8 000	2 000	10 000	160 000	95 000
Data processing services	313 092	1 613 000	30 200	440 800	471 000	2 084 000	2 195 000
Laboratory services	436 780	868 000	45 000	(73 000)	(28 000)	840 000	880 000
Legal services	118 000	123 000	6 000	-	6 000	129 000	139 000
TOTAL	7,701 484	12 177 000	630 200	2 845 800	3 476 000	15 653 000	18 443 000

SUMMARY OF MANPOWER

Table K. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
DDG	1	1	1	-	1	1
D	4	4	4	-	4	5
P-5	28	30	30	11	41	46
P-4	41	64	64	23	87	99
P-3	34	39	39	13	52	53
P-2	3	3	3	(3)	-	-
Sub-total	111	141	141	44	185	204
GS	50	72	72	26	98	124
TOTAL	161	213	213	70	283	328

CHANGES IN COSTS AND MANPOWER

Costs

- K.1. As will be seen from Table K.1 above, it is expected that the cost of this programme will increase by \$3 476 000, of which \$630 200 will be required to cover salary and other price increases and \$2 845 800 will be the overall programme increase.
- K.2. The programme increase of \$2 274 600 in respect of salaries for established posts and common staff costs is attributable to the addition of 44 Professional and 26 GS posts in 1979 and to the additional cost in 1979 of posts for which funds were provided in the 1978 budget for only part of the year.
- K.3. Programme increases of \$1900 foreseen in respect of overtime and temporary assistance will be offset by a programme decrease of \$15 800 in respect of consultants' services (where an increase in respect of "Safeguards effectiveness evaluation" is more than offset by decreases in respect of "Safeguards development and technical support" and "Safeguards information treatment"). Of the programme increase of \$110 300 in respect of travel the greater part represents an increase in travel in connection with inspections; increased travel under the "Safeguards development and technical support" sub-programme - in connection with research contract co-ordination, instrument development and testing and safeguards experiments - accounts for only \$9000.
- K.4. A programme decrease of \$61 000 in respect of symposia and seminars is attributable to the fact that the number of meetings planned for 1979 in connection with the "Safeguards development and technical support" sub-programme is one less than in the 1978 budget and that less funds will be required for a meeting in connection with the "Safeguards information treatment" sub-programme. The programme increase of \$66 000 in respect of technical committees and advisory groups is attributable to an increase of three in the number of meetings planned.
- K.5. The programme increase of \$94 000 in respect of scientific and technical contracts relates mainly to service contracts for the analytical laboratory network run in connection with the "Safeguards development and technical support" sub-programme; only \$4000 is for a technical contract for the development of direct computer communications with Member States, under the "Safeguards information treatment" sub-programme.
- K.6. As regards service costs, increases are foreseen in respect of linguistic services (\$6000), printing and publishing services (\$2000) and data processing services (\$440 800). A reduction of \$73 000 is foreseen in respect of laboratory services due to the fact that the Safeguards Analytical Laboratory provides services also for other programmes.
- K.7. The Canadian Government will support the "Safeguards" programme with a contribution of \$120 000 in 1979. It is expected that the Government of the United States and the Government of the Soviet Union will continue to support the programme, with contributions of about \$700 000 and \$330 000 respectively.

Manpower

- K.8. As will be seen from Table K.2 above, the addition of 44 Professional and 26 GS posts is foreseen for 1979. It is also foreseen that three Professional posts will be reclassified from the P-2 to the P-3 level. Detailed justifications for the additional posts and the reclassifications are provided in Annex V.
- K.9. For 1980 the addition of 19 Professional and 26 GS posts is foreseen.

THE PROGRAMME

OBJECTIVE

K.10. The objective is to apply safeguards under agreements to which the Agency is a party, through the establishment of safeguards concepts and criteria, the implementation of established safeguards procedures and practices and the co-ordination and furtherance of development work leading to the achievement of the safeguards objective in the most efficient way.

RESULTS TO DATE

K.11. So far 134 safeguards agreements (23 project agreements, 31 trilateral agreements, 16 unilateral submission agreements and 64 agreements in connection with NPT) have been concluded; 119 of them - including 51 NPT agreements - have entered into force.

K.12. With the entry into force of NPT safeguards agreements, the application of safeguards under other agreements with the countries concerned has in most cases been suspended. At the same time, there are NPT and non-NPT agreements in force whose provisions have not yet been implemented because the countries concerned have no material to be safeguarded under the agreements in question.

K.13. Accordingly, the Agency is applying safeguards in 50 States which have significant nuclear activities; in 30 States under NPT agreements and in 20 States under non-NPT agreements.

PLANS FOR 1979-84

K.14. The following table indicates the quantities of nuclear material expected to be under Agency safeguards during the years to 1984; the nuclear material expected to be subject to Agency safeguards pursuant to the voluntary offers made by France, the United Kingdom and the United States is not included.

Quantities of nuclear material under Agency safeguards
1977-84

Table K. 3

Material	Amounts (tonnes)		
	1977	1979	1984
Plutonium	36	70	200
Uranium enriched to more than 20%	11	15	25
Uranium enriched to less than 20%	7 849	13 000	30 000
Source material	12 234	15 000	35 000

K.15. It is expected that, during the period 1979-84, the Standing Advisory Group on Safeguards Implementation (SAGSI) will continue to evaluate the technical objectives of safeguards, assess the effectiveness of safeguards and give advice on operational techniques (Standing Advisory Group - Annex II (95-97); probably three sessions also in 1980).

CO-OPERATION WITH OTHER ORGANIZATIONS

K.16. The programme involves co-operation with national and regional nuclear energy authorities.

STRUCTURE

K.17. This programme consists of five sub-programmes, which are dealt with separately below. The Deputy Director General for Safeguards assures the overall co-ordination and direction of the two Divisions of Operations, the Division of Development and Technical Support, the Division of Safeguards Information Treatment, the Section for Standardization and Administrative Support and the Safeguards Evaluation Section, each of which is involved in an interconnected manner in the implementation of the programme.

Summary of manpower by organization unit and category

Table K. 4

Organization unit	1977 Adjusted budget			1978 Adjusted budget			1979 Estimate			1980 Preliminary estimate		
	P	GS	Total	P	GS	Total	P	GS	Total	P	GS	Total
Programme co-ordination	2	3	5	2	4	6	2	5	7	2	5	7
Safeguards operations A and B	73	21	94	90	27	117	124	40	164	134	44	178
Safeguards development and technical support	20	8	28	24	12	36	27	14	41	30	18	48
Standardization and administrative support	4	4	8	5	4	9	6	4	10	7	4	11
Safeguards information treatment	12	14	26	17	23	40	20	31	51	23	47	70
Safeguards effectiveness evaluation	-	-	-	3	2	5	6	4	10	8	6	14
TOTAL	111	50	161	141	72	213	185	98	283	204	124	328

Cost of safeguards programme co-ordination

Table K. 5

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	182 329	142 000	11 000	9 000	20 000	162 000	170 000
Overtime	442	200	-	300	300	500	600
Sub-total	182 771	142 200	11 000	9 300	20 300	162 500	170 600
Common staff costs	50 381	40 300	2 700	2 000	4 700	45 000	46 500
Travel	8 635	10 000	700	1 300	2 000	12 000	13 000
Meetings							
Technical committees, advisory groups	35 109	48 000	1 500	25 500	27 000	75 000	80 400
Representation and hospitality	2 596	2 500	-	-	-	2 500	2 500
Scientific supplies and equipment	817 204	814 000	57 000	-	57 000	871 000	913 000
Common services, supplies and equipment	67 410	-	-	-	-	-	-
Transfer of costs:							
Linguistic services	14 897	14 000	1 000	4 000	5 000	19 000	21 000
Printing and publishing services	11 431	19 000	1 000	(1 000)	-	19 000	19 000
TOTAL	1 190 434	1 090 000	74 900	41 100	116 000	1 206 000	1 266 000

Cost of safeguards operations A and B

Table K. 6

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	2 139 855	3 086 000	187 000	1 269 000	1 456 000	4 542 000	5 440 000
Overtime	520	600	-	400	400	1 000	1 000
Temporary assistance	8 676	-	-	-	-	-	5 000
Sub-total	2 149 051	3 086 600	187 000	1 269 400	1 456 400	4 543 000	5 446 000
Common staff costs	591 322	896 200	20 300	354 800	375 100	1 271 300	1 496 000
Travel	547 199	611 000	43 000	91 000	134 000	745 000	980 000
Representation and hospitality	3 070	4 200	300	(800)	(500)	3 700	5 000
Transfer of costs:							
Linguistic services	38 728	64 000	4 000	(1 000)	3 000	67 000	70 000
Printing and publishing services	4 260	47 000	2 500	(1 500)	1 000	48 000	37 000
Legal services	118 000	123 000	6 000	-	6 000	129 000	139 000
TOTAL	3 451 630	4 832 000	263 100	1 711 900	1 975 000	6 807 000	8 173 000

Cost of safeguards development and technical support

Table K. 7

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	756 419	1 006 000	77 000	142 000	219 000	1 225 000	1 460 000
Consultants	11 534	43 000	1 300	(22 300)	(21 000)	22 000	19 500
Overtime	97	300	-	100	100	400	500
Sub-total	768 050	1 049 300	78 300	119 800	198 100	1 247 400	1 480 000
Common staff costs	209 020	292 000	11 000	39 600	50 600	342 600	401 700
Travel	45 815	57 000	4 000	9 000	13 000	70 000	80 000
Meetings							
Conferences, symposia, seminars	-	109 000	4 000	(53 000)	(49 000)	60 000	60 000
Technical committees, advisory groups	110 306	82 000	3 500	(1 500)	2 000	84 000	90 000
Representation and hospitality	3 533	4 700	300	-	300	5 000	5 300
Scientific and technical contracts	136 378	400 000	20 000	90 000	110 000	510 000	760 000
Transfer of costs:							
Linguistic services	12 051	44 000	2 000	(8 000)	(6 000)	38 000	42 000
Printing and publishing services	21 891	79 000	4 200	2 800	7 000	86 000	25 000
Laboratory services	436 781	868 000	45 000	(73 000)	(28 000)	840 000	880 000
TOTAL	1 743 825	2 985 000	172 300	125 700	298 000	3 283 000	3 824 000

Cost of standardization and administrative support

Table K. 8

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	219 245	233 000	14 000	26 000	40 000	273 000	345 000
Overtime	-	200	-	200	200	400	500
Sub-total	219 245	233 200	14 000	26 200	40 200	273 400	345 500
Common staff costs	60 584	67 600	1 600	7 000	8 600	76 200	94 500
Travel	2 285	-	-	2 000	2 000	2 000	2 500
Representation and hospitality	150	200	-	200	200	400	500
Transfer of costs:							
Linguistic services	8 726	9 000	500	9 500	10 000	19 000	20 000
Printing and publishing services	1 233	3 000	200	800	1 000	4 000	5 000
TOTAL	292 223	313 000	16 300	45 700	62 000	375 000	468 000

Cost of safeguards information treatment

Table K. 9

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	506 151	838 000	53 000	202 000	255 000	1 093 000	1 440 000
Consultants	20 764	43 000	1 500	(17 500)	(16 000)	27 000	16 000
Overtime	41	1 200	100	200	300	1 500	2 000
Temporary assistance	70	2 200	100	200	300	2 500	3 000
Sub-total	527 026	884 400	54 700	184 900	239 600	1 124 000	1 461 000
Common staff costs	139 864	242 500	7 000	56 000	63 000	305 500	396 000
Travel	8 069	15 000	1 000	4 000	5 000	20 000	22 000
Meetings							
Conferences, symposia, seminars	21 244	32 000	1 000	(8 000)	(7 000)	25 000	28 000
Technical committees, advisory groups	-	-	-	42 000	42 000	42 000	46 000
Representation and hospitality	942	1 100	100	300	400	1 500	2 000
Scientific and technical contracts	5 000	20 000	1 000	4 000	5 000	25 000	25 000
Transfer of costs:							
Linguistic services	831	9 000	500	1 500	2 000	11 000	13 000
Printing and publishing services	7 304	2 000	100	900	1 000	3 000	9 000
Data processing services	313 092	1 613 000	30 200	440 800	471 000	2 084 000	2 195 000
TOTAL	1 023 372	2 819 000	95 600	726 400	822 000	3 641 000	4 197 000

Cost of safeguards effectiveness evaluation

Table K.10

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	-	107 000	7 000	131 000	138 000	245 000	400 000
Consultants	-	-	-	24 000	24 000	24 000	-
Overtime	-	-	-	500	500	500	600
Sub-total	-	107 000	7 000	155 500	162 500	269 500	400 600
Common staff costs	-	31 000	1 000	36 200	37 200	68 200	110 000
Travel	-	-	-	3 000	3 000	3 000	4 000
Representation and hospitality	-	-	-	300	300	300	400
TOTAL	-	138 000	8 000	195 000	203 000	341 000	515 000

Safeguards operations

OBJECTIVE

K.18. The objective is to apply safeguards pursuant to agreements in connection with NPT and to unilateral submission agreements, safeguards transfer agreements and project agreements concluded under the Agency's Safeguards System (1965, as Provisionally Extended in 1966 and 1968)[K. 1], the main activities involved in fulfilling this objective including:

- (a) Collection and evaluation of design information;
- (b) Evaluation of nuclear material accountancy;
- (c) Performance of inspections for the purpose of verifying information received from States;
- (d) Preparation and formulation of technical conclusions on nuclear material accountancy;
- (e) Technical preparation of subsidiary arrangements; and
- (f) Elaboration and updating of Safeguards Implementation Practices (SIPs).

RESULTS TO DATE

K.19. Safeguards are at present being applied in 50 States under 9 project agreements, 18 trilateral agreements, 10 unilateral submission agreements and 24 NPT agreements.

K.20. During the past six years about 3100 inspections were carried out, statements on the technical conclusions being transmitted to the Governments of the States concerned.

K.21. Several safeguards training courses have been held at the Agency's Headquarters and - with the assistance of national authorities - in Member States, and during the past six years over 70 inspectors have received instruction in the basic principles and practices of Agency safeguards operations. Courses designed to update the knowledge and skills of experienced inspectors have also been held.

K.22. So far, SIPs have been elaborated for about 100 facilities.

PLANS FOR 1979-80

K.23. It is expected that in 1979 safeguards will be applied in 35 States having nuclear material subject to agreements in connection with NPT and in 17 States having nuclear material subject to other agreements.

K.24. It is currently estimated that in 1979 safeguards will extend to nuclear material in 588 facilities. Since the type and number of facilities to be covered by agreements pursuant to the voluntary offers of France, the United Kingdom and the United States are not yet known, the following table does not include facilities in those countries.

[K. 1] Reproduced in document INFCIRC/66/Rev. 2.

Nuclear installations subject to safeguards
1977-79

Table K. 11

Type of installation	1977		1978		1979		1979 Total
	NPT agreements	Other agreements	NPT agreements	Other agreements	NPT agreements	Other agreements	
Power reactors	78	22	93	19	99	19	118
Conversion and fuel fabrication plants	21	2	24	2	24	3	27
Enrichment plants	1	0	1	0	1	0	1
Reprocessing plants	3	0	6	1	6	2	8
Pilot fuel fabrication plants	11	2	11	2	11	2	13
Pilot enrichment plants	2	0	2	0	2	0	2
Pilot reprocessing plants	1	1	1	1	1	1	2
Research reactors and critical facilities	135	34	145	24	145	24	169
Sub-critical facilities	15	1	15	1	15	1	16
Research and development facilities	39	1	39	1	39	1	40
Other locations	180	10	185	7	185	7	192
TOTALS	486	73	522	58	528	60	588

K. 25. The work load is expected to grow in 1979 as a result of the expansion of nuclear activities in States having safeguards agreements with the Agency, because of the re-
definition of safeguards criteria with a view to greater effectiveness and due to the
increase arising out of the application of safeguards to facilities in France, the United
Kingdom and the United States and out of other new agreements.

K. 26. The programme of basic and advanced training courses for inspectors will
continue.

K. 27. SIPs will be established for facilities not so far covered, especially for facilities
in EURATOM countries, and all SIPs will be kept under constant review.

K. 28. It is expected that the establishment of regional offices at or the posting of
resident inspectors to bulk-handling facilities will result in manpower savings.

RELATED ACTIVITIES

K. 29. The Agency's Laboratory, including the Safeguards Analytical Laboratory (SAL),
will support this sub-programme in two ways: firstly (in its function as part of a network of
safeguards analytical laboratories) by carrying out analyses of the samples collected by
inspectors and secondly by assembling, calibrating and servicing the surveillance, non-
destructive analysis and other equipment used in the field by inspectors. The monitoring of
personnel for radiation doses received on duty in the field will continue to be carried out by
the Division of Nuclear Safety and Environmental Protection. The Division of Scientific and
Technical Information will provide computer services for the processing of safeguards data.
The Legal Division and the Division of External Relations will participate in the negotiation
of safeguards agreements.

PLANS FOR 1981-84

K. 30. During this period, which should see a continuing increase in the proportion of the world's energy demand being met by nuclear power, the inspectorate is expected to grow more slowly than the amount of nuclear materials under safeguards. More effective verification techniques and instruments will support this trend.

K. 31. A variety of training courses for inspectors will be held.

CO-OPERATION WITH OTHER ORGANIZATIONS

K. 32. The economical implementation of this sub-programme will continue to depend on the co-operation of national and regional authorities responsible for administering States' systems of accounting for and control of nuclear material (SSACs) and for the management of safeguarded facilities. The co-operation of States in providing training in specialized fields will continue to be sought.

Safeguards development and technical support

OBJECTIVE

K. 33. The objective is to provide procedures, techniques, equipment and technical support for achieving the technical objectives of safeguards in the most effective and economical way, the main activities involved in fulfilling this objective including:

- (a) Direct support for operational activities through the provision of technical services such as the procurement, storage, testing, calibration, maintenance, servicing, shipment and installation of safeguards instruments and equipment, the instruction of inspectors, arrangements for the shipment and analysis of samples, supervision of the programme of and the work performed at the Agency's Safeguards Analytical Laboratory, the specification and procurement of physical standards and reference materials and the formulation of procedures for implementing techniques for containment, surveillance and nuclear material measurement;
- (b) Support for operational activities through the development, optimization and introduction into operational use of destructive and non-destructive assay instruments and techniques, surveillance instruments, containment techniques and seals and through the co-ordination of research in those fields; and
- (c) The improvement of safeguards effectiveness through the further development, the refinement and the evaluation of safeguards objectives, concepts, approaches and criteria, the forecasting of fuel cycle activities and of inspection and consequent manpower requirements, the organization of safeguards training and the updating of technical documentation.

RESULTS TO DATE

K. 34. In the course of the reorganization of the Department of Safeguards in 1977, when the Division of Development was renamed "Division of Development and Technical Support", a "Section for Technical Services" was established; it has started to assume responsibility for the activities mentioned in sub-paragraph K. 33(a) above.

K. 35. Portable, compact high-resolution gamma spectrometers and gamma measurement data processing units have been developed to an advanced stage and are in routine use for the verification of feed, product and scrap material, particularly at bulk-handling facilities.

In-the-field verification of operators' statements on large packages of plutonium-containing material has been made possible by combining high-level neutron coincidence counting with high-resolution gamma spectrometry.

K. 36. Development work on unattended closed-circuit television surveillance has continued and a number of surveillance systems have been incorporated in normal inspection regimes. A co-ordinated research programme on the use of installed instrumentation at fuel reprocessing facilities has been initiated (Table K. 12, No. 2).

K. 37. Preliminary safeguards concepts for enrichment facilities, plutonium-uranium mixed oxide fuel fabrication plants and CANDU-type reactors have been formulated and safeguards concepts and criteria (such as threshold amounts, significant quantities, critical time and timeliness of detection) provisionally defined.

K. 38. A computerized data base system for forecasting world-wide nuclear activities has been designed and partially tested. Forecasts of the number of facilities and quantities of nuclear material under safeguards to the year 2000 have been made.

K. 39. The possibility of using isotopic correlation techniques in safeguards verification activities has been investigated under a co-ordinated research programme (Table K. 12, No. 1), and a bank of correlated isotopic data is being set up.

K. 40. The Divisions of Operations have received continuous support through:

- (a) the provision of technical services and inspector training;
- (b) the implementation of new methods and techniques in the field; and
- (c) assistance in the negotiation of subsidiary arrangements and facility attachments.

K. 41. The work of the Division of Development and Technical Support has been significantly promoted and accelerated by the comprehensive assistance of several Member States.

PLANS FOR 1979-80

K. 42. In the course of work on developing safeguards procedures, methods and instruments, a comprehensive study will be made of safeguards approaches for the main types of nuclear facility, with special emphasis on facilities processing or handling weapons-usable nuclear material; fuel element fabrication plants will be considered in 1979 (Advisory Group - Annex II (101)) and other types of facility in 1980 (Advisory Group).

K. 43. Procedures and rationales for the safeguarding of uranium enrichment facilities, reprocessing plants, fuel fabrication plants, LWRs, CANDU-type reactors, HTGRs, fast breeder reactors, critical facilities and non-nuclear materials will be further developed, improved and updated. The comprehensive study will include diversion analyses, estimates of inspection effort requirements and further research and development activities.

K. 44. Developed safeguards procedures will be tested at operating facilities, great importance being attached to field exercises at reprocessing plants, plutonium-uranium mixed oxide fuel fabrication plants and critical facilities. The purpose of such field exercises will be to prove evaluation methods and to test alternative safeguards approaches, and they will serve as the basis for the development of implementation guidelines.

K. 45. Through the modelling of nuclear activities and of related effective safeguards (Advisory Group - Annex II (99)), safeguards concepts and criteria (such as significant quantities and timeliness of detection) will undergo continuous development and updating. It is also planned to develop criteria for safeguards effectiveness evaluation, and factors

influencing international safeguards effectiveness will be carefully studied. Practical yardsticks by which the effectiveness of safeguards actions can be gauged will be developed. On the basis of safeguards criteria and objectives, a model for effective safeguards will be developed by determining procedures and methods for generic types of facility and designing alternative safeguards systems for different types of nuclear fuel cycle.

K.46. Procedures for deriving quantitative information from the application of containment/surveillance measures at different types of facility will be developed. Special consideration will be given to the role of containment/surveillance and other qualitative measures in enhancing the effectiveness of international safeguards at large nuclear facilities.

K.47. The status of and development work on safeguards techniques will be reviewed and the objectives for the development of safeguards techniques during the period 1980-85 will be identified in 1979. Measurement techniques for the verification of nuclear material in reprocessing facilities will be reviewed in 1980 (Advisory Group).

K.48. Work will continue in particular on the development, testing, demonstration and optimization of methods, techniques and instrumentation for:

- (a) Determining quantities of nuclear material and identifying items, with efforts concentrated on developing
 - (i) a portable neutron detection system for measuring the uranium-235 content of non-irradiated fuel assemblies (1979),
 - (ii) transportable calorimeters for the very precise assay of plutonium in small samples, pellets, cans and fuel rods (1979),
 - (iii) a portable/transportable system for the active assay of highly enriched uranium in fuel assemblies, containers and scrap (1979-80),
 - (iv) a stabilized portable gamma spectrometer with microprocessor for measuring uranium-235 enrichment and/or uranium/plutonium content (1979),
 - (v) seals suitable for verification of the identity and integrity of LWR fuel assemblies (expected to be available for demonstration and testing by the end of 1980) and
 - (vi) a portable device for the in situ verification of spent fuel (1979-80) (Advisory Group - Annex II (98));
- (b) The surveillance of containment systems and of nuclear material flows and inventories, including
 - (i) an advanced fibre optic sealing system with a data storage and remote interrogation capability (1979) and
 - (ii) an advanced television surveillance system with increased reliability, secure transmission and high-capacity batteries for operation independent of the mains power supply (1979-80);
- (c) Providing, in an automated fashion, instantaneous and continuous information relating to nuclear material quantities and to the surveillance of containment systems and nuclear material flows (to reduce the need for the permanent presence of inspectors in locations with large inventories of easily convertible materials, the development of on-line interrogation capabilities

for surveillance and containment systems has started, and it is expected that, by the end of 1980, remote-interrogable television systems and seals will have been developed);

- (d) Integrating measurement techniques with containment and surveillance methods so as to achieve uniformly effective safeguards across an entire facility (development work on an integrated system for counting the number and following the movement of spent fuel bundles, together with radiation-measuring instruments to verify inventories of irradiated fuel in spent-fuel bays and sealable covers on stacks of baskets containing large numbers of fuel bundles under surveillance by unattended television cameras, will be carried out during the period 1979-81); and
- (e) Processing measurement data with the help of automated systems which are rapid, accurate and simple to operate - a main system, based on the Agency's ND 6620 minicomputer, for the transfer and analysis of spectrum measurement data recorded by inspectors on magnetic tape (in cassettes) using the portable gamma spectrometer referred to in sub-paragraph K. 48(a)(iv) above and software, which is expected to be in routine use by the end of 1979 and will be continuously extended and improved during the period 1980-84, for evaluation of the gamma-spectrometric determination of plutonium isotopic composition, burn-up and uranium-235 enrichment (it is foreseen that the ND 6620 minicomputer, together with the Agency's IBM 370/158 computer, will at a later date become directly accessible to inspectors for in-the-field use via telephone line transmission); a system (expected to be developed by the end of 1979) for in-the-field processing of gamma spectra through the use of portable, desk-type calculators which accept and process spectrum measurement data.

K. 49. Also in support of safeguards operational activities, information will be provided on nuclear material flows and inventories, and forecasts will be made of nuclear fuel cycle growth and the Agency's consequent budgetary and equipment needs for inspection activities. This will be done by means of the computerized data base forecasting system referred to under "RESULTS TO DATE".

K. 50. Guidance will be given in the practical application of updated safeguards approaches and methods, continuous support being provided to operational sections in the preparation of practical safeguards procedures, subsidiary arrangements and facility attachments, in the analysis of safeguards limitations and in the development of alternative procedures for safeguarding specific facilities; assistance will also be given in the conduct of safeguards negotiations with States.

K. 51. Technical services such as equipment and sample management and supervision of the Safeguards Analytical Laboratory will continue to be provided; in 1980, problems relating to the characterization, certification and use of non-destructive assay standards will be reviewed (Advisory Group). Field operation manuals will be produced.

K. 52. Newly developed instruments and techniques will be demonstrated in typical operational environments - for example, newly developed equipment for measuring plutonium scrap and waste at plutonium-handling facilities will be demonstrated in a European Member State (1978-79), radiography will be used for identifying and measuring plutonium in nuclear material in another Member State (1979) and the usefulness of isotopic correlation techniques as practical inspection tools for reprocessing plants will be investigated (1980).

K. 53. Capabilities in the field of instrument testing, calibration, maintenance and repair will be increased (a safeguards instrument laboratory at Seibersdorf is expected to be operational by the end of 1979). A preventive maintenance regime will be instituted, and the cost-effectiveness of technical services will be improved through the development of a computerized system for scheduling instrument maintenance and routing instruments (1980).

K. 54. In the provision of basic and advanced training for Agency inspectors, increasing emphasis will be placed on the use of techniques being developed in the field of adult education. Special training in the application of new safeguards procedures and techniques will be provided.

K. 55. Staff of the Division of Development and Technical Support will participate in inspections where particularly sophisticated and accurate measurements and techniques are necessary. It is expected that, during the period 1979-80, special assistance will be required for the measurement of plutonium-containing fuel and of LWR fuel with varying uranium-235 enrichment and neutron poison content.

K. 56. Instrumented vehicles to facilitate the use by inspectors of portable and transportable non-destructive assay systems, including computation equipment and equipment for processing safeguards data during physical inventory verification and other inspection activities, will be provided, the aim being to have the first vehicle operational (in Europe) early in 1979 and a second-generation vehicle operational by the end of 1979.

K. 57. The effectiveness of specific safeguards approaches and procedures applied by the operational sections will be continuously reviewed and in 1979 (Advisory Group - Annex II (100)) recommendations for their improvement will be made.

K. 58. The Safeguards Technical Manual will be continuously updated (an updated version of Part E is expected to be ready for publication early in 1980).

K. 59. The training programmes for new and experienced Agency inspectors will be improved continuously, account being taken of the information gained through - for example - the debriefing of inspectors, equipment performance and actual requirements. An outline for a comprehensive inspector training programme will be completed in 1979.

K. 60. In support of Member States, procedures will be developed for evaluating and improving the effectiveness of SSACs. Recommendations for the establishment and maintenance of SSACs are expected to be issued this year and continuously updated during subsequent years; there will be a review of such recommendations in 1980 (Advisory Group).

K. 61. Member States will be given technical support - including the services of specialists from the Agency and from other Member States - in establishing SSACs, whereby the necessary co-ordination between the safeguards activities of the Agency and of the States will be ensured.

RELATED ACTIVITIES

K. 62. Comprehensive and continuous training for SSAC personnel will be provided through courses on legal, administrative and technical aspects of safeguards; basic and advanced training will be organized in 1979 (Seminars - Annex I (26 and 27)) and in 1980 (Seminars).

PLANS FOR 1981-84

K. 63. For the purpose of increasing the effectiveness of the safeguards system, safeguards objectives, criteria and procedures will continue to be reviewed and refined in the light of the experience gained in safeguards implementation. Particular emphasis will be placed on safeguarding large nuclear facilities, new types of facility and weapons-usable nuclear material.

CO-OPERATION WITH OTHER ORGANIZATIONS

K. 64. As the Agency does not have safeguards research facilities of its own, further technical developments in the field of safeguards will depend to a large extent on the

assistance of Member States. Assistance has been offered by several Member States, and it is expected that during the period 1979-80 (in addition to the cost-free services of five to eight experts) research and development work equivalent to \$3-4 million will be carried out in Member States in direct support of Agency safeguards. To ensure the most effective use of the results of this work, Agency staff will participate in its planning, co-ordination and execution.

Safeguards information treatment

OBJECTIVE

K. 65. The objective is to process all types of safeguards data, provide services relating to the evaluation of safeguards data and results and continue developing an advanced safeguards information system in order to make available improved tools for data processing and evaluation, the main activities involved in fulfilling this objective including:

- (a) Co-ordination and facilitation of the flow of safeguards information;
- (b) The operation of input editing, computer program and output control services and the provision of documentation and training in connection with safeguards information treatment;
- (c) Continuation of the designing, development, documenting and implementation of procedures and computer programs for safeguards information treatment; and
- (d) The provision of data evaluation services relating to inspection working papers, inspection sampling plans, measurement results, analytical results, inspection reports, safeguards statements to be transmitted to individual countries and safeguards implementation reports to be submitted to the Board of Governors.

RESULTS TO DATE

K. 66. A computer-based system for the processing of nuclear material accounting data supplied by States has been in use since 1975. As of 31 December 1977, the associated safeguards data base consisted of more than 9500 reports containing over 200 000 records; in addition, over a thousand records from inspection reports were added to the data base during 1977. The rate of input to the data base is now about 12 000 records a month. During 1977, approximately 15 000 queries were put to the system - in order to satisfy the data needs of the inspectorate, the Safeguards Evaluation Section and certain other units within the Department of Safeguards - and the resulting output from the system analysed. Results from queries were distributed to inspectors, to country officers and to management and were included in the Special Safeguards Implementation Report.

K. 67. Computerization of the comparison of records from SSACs and from inspection reports has been expanded, with a view to expediting support for inspectors in their evaluation work.

K. 68. Commercially available data base management systems were evaluated and the ADABAS system, donated by the Federal Republic of Germany, was introduced into the Agency's computer system; the safeguards data base is in the process of being loaded into the data base management system. Overall designing of an advanced safeguards information system structured according to ADABAS has been completed and detailed design work on the various parts of the advanced system is now under way. The advanced system is scheduled to start routine operations with safeguards accounting data this year. The expected increase in the number of required safeguards data elements, forecasts of the

growth in the volume of accounting and inspection data and the increasing complexity of data processing requirements have resulted in a recognition of the fact that the Agency's computer capacity must be significantly expanded in order to meet the needs of safeguards; new, advanced computer hardware and software have already been introduced.

K. 69. The third seminar for SSAC personnel, held in September 1977, was attended not only by personnel from NPT States but also, for the first time, by personnel from non-NPT States, the aim being to improve their understanding for the accuracy and other requirements which should be met in the reports submitted to the Agency pursuant to the provisions set forth in Agency document INFCIRC/66/Rev.2 as well as in document INFCIRC/153.

K. 70. Following completion of the overall design of the services for data evaluation, interlaboratory tests have been performed and the results evaluated, numerous sampling plans have been developed, measurement methods and equipment have been calibrated and analyses of destructive and non-destructive measurements carried out (the results being made available to inspectors) and the Special Safeguards Implementation Report for 1976 has been prepared.

K. 71. Staff members from the Division of Safeguards Information Treatment have accompanied inspectors during inspections in order to assist in auditing facility records, in reconciling records and reports and in updating design information and book inventories.

PLANS FOR 1979-80

K. 72. The advanced safeguards information system will be extended so that it can handle the volumes of data indicated below. In particular, all information collected by inspectors will be prepared for computer processing, the results of which will be made available to the other Divisions of the Department of Safeguards.

K. 73. With the forthcoming start of information provision by Japan, the United Kingdom and the United States, and with the completion of the changeover by EURATOM to the Agency's reporting procedures, it is expected that the following volumes of data will have to be processed:

	<u>Accounting reports</u>	<u>Accounting records</u>	<u>Inspection records</u>
1978	~8 000	~350 000	~50 000
1979	~13 000	~550 000	~100 000
1980	~15 000	~800 000	~200 000

K. 74. Workshops on the processing and evaluation of safeguards information will be held for SSAC personnel in 1979 (Seminar - Annex I (28)) and 1980 (Seminar); courses on the same subject will also be organized for Agency inspectors.

K. 75. The programme under which inspectors in the field are assisted by experienced staff members from the Division of Safeguards Information Treatment will be expanded.

K. 76. Work on data evaluation will be co-ordinated with the activities of the Safeguards Evaluation Section; it will include the organization of the information flow, the development of further sampling plans and the provision of statistical services.

K. 77. The quality of safeguards data obtained by both destructive and non-destructive measurement techniques will be reviewed in 1979 (Advisory Groups - Annex II (102 and 103)) and in 1980 (Advisory Groups).

RELATED ACTIVITIES

K. 78. If the expected increase in the volumes of data to be processed materializes, the Agency's computer capacity will have to be expanded. The necessary hardware and software will continue to be provided through co-operation between the Division of Safeguards Information Treatment and the Computer Section.

PLANS FOR 1981-84

K. 79. The activities described under "PLANS FOR 1979-80", including the adaptation and expansion of the safeguards information treatment system, will continue and the co-operation necessary for ensuring its effectiveness will be maintained.

Safeguards effectiveness evaluation

OBJECTIVE

K. 80. The objective is to carry out independent assessments of safeguards statements to be transmitted to individual countries, to ensure a continuing evaluation of the effectiveness of safeguards activities and to recommend the improvement of all aspects of the safeguards system where it is deemed necessary, the main activities involved in fulfilling this objective including:

- (a) The review of all inspection reports, analysis of the difficulties encountered in the planning and implementation of inspections and the formulation of proposals for improvements in inspection activities;
- (b) The monitoring of all activities relating to evaluation of the effectiveness of the safeguards system;
- (c) Continuous evaluation of the effectiveness of safeguards implementation;
- (d) Guiding the evaluation process and co-operating with other units within the Agency in improving the safeguards system and the effectiveness of safeguards implementation; and
- (e) The formulation of conclusions regarding safeguards effectiveness, particularly in the Safeguards Implementation Report.

RESULTS TO DATE

K. 81. This sub-programme was established in 1977 and some of the functions previously performed within other units - for example, the reviewing of inspection reports, the assessment of safeguards statements before their transmission to States and the preparation of the Safeguards Implementation Report - were transferred to it.

PLANS FOR 1979-80

K. 82. Inspection reports will be reviewed and safeguards statements on the Agency's verification activities will be assessed as part of a continuing, independent scrutiny carried out before the safeguards statements are transmitted to individual countries. Approximately a thousand inspection reports will be reviewed in 1979.

K. 83. Methods will be introduced for the continuous compilation of information to be used as a basis for the Safeguards Implementation Report, which will be prepared by Safeguards Evaluation Section with the help of other units within the Agency, and particularly within the Department of Safeguards.

K. 84. Further safeguards effectiveness evaluation procedures will be devised.

PLANS FOR 1981-84

K. 85. The activities described under "PLANS FOR 1979-80" will continue and be extended to include the performance of all safeguards effectiveness evaluation functions.

Standardization and administrative support

OBJECTIVE

K. 86. The objective is to ensure efficiency and standardization in arrangements with State authorities for the implementation of safeguards agreements, to codify safeguards procedures and, in general, to support the application and administration of safeguards, the main activities involved in fulfilling this objective including:

- (a) Co-ordinating the preparation of the subsidiary arrangements of safeguards agreements;
- (b) Preparing model subsidiary arrangements and facility attachments;
- (c) Participating in the negotiation of agreements and arrangements, so as to ensure the consistency of technical and administrative/legal requirements;
- (d) Codifying the administrative procedures for safeguards implementation; and
- (e) Preparing non-technical safeguards reports, studies and manuals, co-ordinating the flow of documents within the Department of Safeguards, organizing and operating the Department's filing system, compiling operational statistics and providing specialized administrative assistance to the Department of Safeguards as a whole.

RESULTS TO DATE

K. 87. Previously prepared subsidiary arrangements have been reviewed and amended to reflect experience gained in their implementation and to take account of conditions in the States concerned, including the existence of SSACs. Model facility attachments, forming parts of subsidiary arrangements, have been worked out, as has a set of model subsidiary arrangements aimed at making possible a consolidation of subsidiary arrangements so that the same accountancy system can be used for non-NPT States as well as NPT States - the Project Accountancy Compatibility Exercise (PACE). Work on expanding and updating the internal administrative manual of the Department of Safeguards has continued.

PLANS FOR 1979-80

K. 88. As new nuclear facilities are completed, the necessary facility attachments will be prepared and discussed with national authorities, the aim being that they should reflect up-to-date operating methods and safeguards procedures. Subsidiary arrangements already concluded will be reviewed and amended to conform to the latest standards. Administrative

procedures for the application of safeguards and for the evaluation of safeguards results will continue to be developed, codified and refined. Administrative support in the application of safeguards is expected to grow in scope and importance.

PLANS FOR 1981-84

K. 89. The entire administrative system - including subsidiary arrangements - for establishing conditions for the implementation of safeguards agreements will be continuously reviewed and streamlined in the light of experience and of advances in nuclear and safeguards technology. As new facility attachments are completed, standardization work will become more intensive and a continuous review of old subsidiary arrangements will be called for. Codification of the procedures for administrative support will continue.

Co-ordinated research programmes

Table K. 12

Co-ordinated programme title	Number of		Year initiated	Probable year of termination
	Contracts	Agreements		
1. Bank of correlated isotopic data	-	4	1975	1980
2. Use of installed instrumentation at fuel reprocessing facilities for safeguards purposes	4	-	1977	1980

L. INFORMATION AND TECHNICAL SERVICES

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table L. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	1 657 725	2 007 000	137 000	16 000	153 000	2 160 000	2 473 000
Consultants	-	10 000	600	900	1 500	11 500	24 000
Overtime	13 890	15 300	900	3 600	4 500	19 800	20 000
Temporary assistance	23 518	27 600	1 700	(4 800)	(3 100)	24 500	27 000
Sub-total	1 695 133	2 059 900	140 200	15 700	155 900	2 215 800	2 544 000
Common staff costs	458 076	582 000	18 400	3 500	21 900	603 900	679 200
Travel	21 580	30 000	1 900	(8 600)	(6 700)	23 300	37 500
Meetings							
Conferences, symposia, seminars	-	14 000	1 000	1 000	2 000	16 000	18 000
Technical committees, advisory groups	276	36 000	2 000	11 000	13 000	49 000	47 000
Representation and hospitality	1 079	2 800	100	-	100	2 900	3 800
Scientific and technical contracts	29 640	17 300	1 200	5 000	6 200	23 500	23 500
Common services, supplies and equipment	1 296 513	2 462 000	42 600	1 158 000	1 200 600	3 662 600	4 086 000
Other items of expenditure	13 438	8 000	500	11 500	12 000	20 000	27 000
Transfer of costs:							
Linguistic services	49 116	122 000	6 000	(33 000)	(27 000)	95 000	121 000
Printing and publishing services	623 282	678 000	38 000	8 000	46 000	724 000	736 000
Data processing services	(1 012 547)	(2 512 000)	(48 000)	(648 000)	(696 000)	(3 208 000)	(3 541 000)
TOTAL	3 175 586	3 500 000	203 900	524 100	728 000	4 228 000	4 782 000

SUMMARY OF MANPOWER

Table L. 2

Grade of post	Number of established posts					1980 Preliminary estimate
	1977 Adjusted	1978	1978 Adjusted	Change	1979	
D	1	1	1	-	1	1
P-5	3	4	4	-	4	4
P-4	11	10	10	1	11	12
P-3	8	11	11	1	12	14
P-2	5	3	3	(1)	2	2
P-1	5	4	4	-	4	4
Sub-total	33	33	33	1	34	37
GS	75	77	77	-	77	81
TOTAL	108	110	110	1	111	118

CHANGES IN COSTS AND MANPOWER

Costs

- L.1. As will be seen from Table L.1 above, the cost of this programme is expected to increase by \$728 000, of which \$203 900 will be required to cover salary and other price increases and \$524 100 will be a programme increase.
- L.2. The programme increase of \$19 500 in respect of salaries for established posts and common staff costs is attributable to the addition of one Professional post for the "Computer services" sub-programme and the offsetting effect of delayed recruitment of new staff to replace departing staff members. The programme increase of \$900 in respect of consultants' services is required mainly for INIS and that of \$3600 in respect of overtime mainly for the "Computer services" sub-programme. The programme decrease in respect of temporary assistance (\$4800) will affect mainly the "Library services", that in respect of duty travel (\$8600) will affect all sub-programmes.
- L.3. The programme increase of \$11 000 in respect of technical committees and advisory groups is attributable to one additional meeting in connection with INIS. The programme increase of \$5000 in respect of scientific and technical contracts will be required for a study on behalf of the "Computer services" sub-programme which is to be contracted out.
- L.4. The programme increase of \$1 158 000 in respect of common services, supplies and equipment is the net result of a programme increase of \$1 199 000 for the "Computer services" sub-programme, reflecting additional computer rental charges in connection with the operation of a third shift and week-end work and the need for additional equipment, partly offset by programme reductions for INIS (\$21 000) and the Library (\$20 000).
- L.5. The programme increase of \$11 500 foreseen under "Other items of expenditure" covers staff training, mainly under the "Computer services" sub-programme.
- L.6. In the light of actual requirements in previous years, it is expected that a programme decrease of \$33 000 will be possible in respect of linguistic services. A programme increase of \$8000 will be required in respect of printing and publishing services. The amount of \$648 000 shown as a programme decrease in respect of data processing services reflects an increase in the data processing costs allocated to other programmes.
- L.7. As will be seen from Table L.6 below, an amount of \$535 000 will remain as a recoverable charge in 1979; this represents reimbursable services rendered to other organizations. A programme increase of \$219 000 in respect of such services is expected.
- L.8. It is expected that the income from INIS publications will be \$275 000 in 1979 and that the provision of reimbursable computer services for UNIDO and for FAO (in respect of AGRIS) will yield income of \$392 000 and \$143 000 respectively.

Manpower

- L.9. As will be seen from Table L.2 above, the addition of one Professional post and the reclassification of one Professional post from the P-2 to the P-3 level are foreseen for 1979. Detailed justifications are provided in Annex V.
- L.10. For 1980, the addition of three Professional posts and three GS posts for the "Computer services" sub-programme and of one GS post for INIS is foreseen.

Cost of the Office of the Director and the scientific journals

Table L. 3

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	119 300	139 000	9 000	-	9 000	148 000	156 000
Consultants	-	-	-	-	-	-	10 000
Sub-total	119 300	139 000	9 000	-	9 000	148 000	166 000
Common staff costs	32 966	40 800	500	-	500	41 300	42 700
Travel	2 640	4 200	300	(2 000)	(1 700)	2 500	5 000
Representation and hospitality	255	700	-	-	-	700	800
Scientific and technical contracts	17 880	17 300	1 200	-	1 200	18 500	18 500
Transfer of costs:							
Linguistic services	32 578	103 000	5 000	(33 000)	(28 000)	75 000	98 000
Printing and publishing services	264 416	310 000	17 000	(6 000)	11 000	321 000	300 000
Data processing services	1	2 000	-	-	-	2 000	2 000
TOTAL	470 036	617 000	33 000	(41 000)	(8 000)	609 000	633 000

Cost of INIS activities

Table L. 4

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	608 360	689 000	48 000	(10 000)	38 000	727 000	800 000
Consultants	-	5 500	300	700	1 000	6 500	7 000
Overtime	2 450	500	-	500	500	1 000	500
Temporary assistance	21 557	14 100	900	-	900	15 000	12 000
Sub-total	632 367	709 100	49 200	(8 800)	40 400	749 500	819 500
Common staff costs	168 107	199 400	7 000	(2 500)	4 500	203 900	220 000
Travel	12 190	13 400	900	(3 900)	(3 000)	10 400	17 500
Meetings							
Conferences, symposia, seminars	-	14 000	1 000	1 000	2 000	16 000	18 000
Technical committees, advisory groups	276	36 000	2 000	11 000	13 000	49 000	47 000
Representation and hospitality	824	2 100	100	-	100	2 200	3 000
Scientific and technical contracts	5 874	-	-	-	-	-	-
Common services, supplies and equipment	218 230	193 000	12 000	(21 000)	(9 000)	184 000	245 000
Transfer of costs:							
Linguistic services	16 538	18 000	900	-	900	18 900	22 000
Printing and publishing services	337 715	346 000	19 800	13 200	33 000	379 000	406 000
Data processing services	545 898	524 000	10 000	374 000	384 000	908 000	1 068 000
TOTAL	1 938 019	2 055 000	102 900	363 000	465 900	2 520 900	2 866 000

Cost of the Library

Table L. 5

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	194 895	248 000	15 000	-	15 000	263 000	282 000
Consultants	-	-	-	-	-	-	2 000
Overtime	-	1 100	100	-	100	1 200	1 500
Temporary assistance	1 195	4 500	300	(4 300)	(4 000)	500	5 000
Sub-total	196 090	253 600	15 400	(4 300)	11 100	264 700	290 500
Common staff costs	53 855	71 400	2 300		2 300	73 700	77 500
Travel	-	2 000	-	(2 000)	(2 000)	-	3 000
Common services, supplies and equipment	160 301	166 000	10 600	(20 000)	(9 400)	156 600	229 000
Other items of expenditure	-	-	-	-	-	-	2 000
Transfer of costs:							
Linguistic services	-	1 000	100	-	100	1 100	1 000
Printing and publishing services	18 489	11 000	600	400	1 000	12 000	20 000
Data processing services	29 260	45 000	1 000	9 000	10 000	55 000	60 000
TOTAL	457 995	550 000	30 000	(16 900)	13 100	563 100	683 000

Cost of computer services

Table L. 6

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	735 170	931 000	65 000	26 000	91 000	1 022 000	1 235 000
Consultants	-	4 500	300	200	500	5 000	5 000
Overtime	11 440	13 700	800	3 100	3 900	17 600	18 000
Temporary assistance	766	9 000	500	(500)	-	9 000	10 000
Sub-total	747 376	958 200	66 600	28 800	95 400	1 053 600	1 268 000
Common staff costs	203 148	270 400	8 600	6 000	14 600	285 000	339 000
Travel	6 750	10 400	700	(700)	-	10 400	12 000
Scientific and technical contracts	5 886	-	-	5 000	5 000	5 000	5 000
Common services, supplies and equipment	917 982	2 103 000	20 000	1 199 000	1 219 000	3 322 000	3 612 000
Other items of expenditure	13 438	8 000	500	11 500	12 000	20 000	25 000
Transfer of costs:							
Printing and publishing services	2 662	11 000	600	400	1 000	12 000	10 000
Data processing services	(1 587 706)	(3 083 000)	(59 000)	(1 031 000)	(1 090 000)	(4 173 000)	(4 671 000)
TOTAL	309 536	278 000	38 000	219 000	257 000	535 000	600 000

Computer services: Breakdown of costs by programme

Table L. 7

	1977 Actual obligations	1978 Adjusted budget	1979 Estimate	1980 Preliminary estimate
Allocated to other programmes:				
Technical assistance	3 944	8 000	48 000	60 000
Nuclear power and reactors	154 627	263 000	292 000	328 000
Nuclear safety and environmental protection	5 317	-	6 000	8 000
Food and agriculture	6 088	25 000	27 000	30 000
Life sciences	7 299	28 000	30 000	35 000
Physical sciences	85 728	94 000	149 000	175 000
The Laboratory	28 433	35 000	50 000	55 000
Safeguards	313 092	1 613 000	2 084 000	2 195 000
Administration	368 271	382 000	452 000	582 000
General Services	7 146	2 000	20 000	20 000
Service activities	32 602	62 000	50 000	53 000
Sub-total, allocated data processing services (see Table L. 1)	1 012 547	2 512 000	3 208 000	3 541 000
Remaining as a charge to the programme Information and technical services:				
Office of the Director and scientific journals	1	2 000	2 000	2 000
INIS	545 898	524 000	908 000	1 068 000
Library	29 260	45 000	55 000	60 000
Sub-total, data processing services for the Agency (see Table L. 6)	1 587 706	3 083 000	4 173 000	4 671 000
Reimbursable services remaining as a charge to computer services	309 530	278 000	535 000	600 000
TOTAL COSTS	1 897 242	3 361 000	4 708 000	5 271 000

Summary of manpower by organization unit and category

Table L. 8

Organization unit	1977 Adjusted budget			1978 Adjusted budget			1979 Estimate			1980 Preliminary estimate		
	P	GS	Total	P	GS	Total	P	GS	Total	P	GS	Total
Office of the Director	2	4	6	2	5	7	2	5	7	2	5	7
INIS Section	14	24	38	14	24	38	14	24	38	14	25	39
Library	4	10	14	4	10	14	4	10	14	4	10	14
Computer Section	13	37	50	13	38	51	14	38	52	17	41	58
TOTAL	33	75	108	33	77	110	34	77	111	37	81	118

THE PROGRAMME

OBJECTIVE

L.11. The objective is to foster the exchange of scientific and technical information on peaceful uses of atomic energy by assembling such information and disseminating it to Member States, Agency staff and interested international organizations.

STRUCTURE

L.12. This programme consists of four sub-programmes, which are described in the following paragraphs.

SUB - PROGRAMMES

INIS

OBJECTIVE

L.13. The objective is to plan and operate, in collaboration with Member States and using modern computer and reprographic techniques, a comprehensive nuclear information and abstracting service involving the processing of input received from Member States, the provision of output in a variety of forms to Member States for dissemination on a national basis and assistance of Member States in improving their methods of information handling and in gaining more rapid access to nuclear information sources.

RESULTS TO DATE

L.14. Fifty Member States and 13 international organizations are now participating in INIS and the input which they contribute is now approaching 70 000 items a year. By the end of 1977, the file of information built up by INIS since operations commenced in 1970 had grown to 350 000 items. In addition the "library" of publications (reports, standards, patents, theses, etc.) available in microfiche form from the INIS Clearinghouse contained almost 100 000 documents. Following discontinuation in July 1976 of the United States publication Nuclear Science Abstracts, the number of subscriptions to INIS ATOMINDEX increased significantly, reaching 1800 by the end of 1977.

L.15. The INIS data processing procedures involve the use of some of the latest data processing techniques, including optical character recognition (OCR) and on-line data entry and correction using computer terminals. With the acquisition in 1977 of photocomposition equipment of the most advanced design, INIS now has at its disposal a self-contained production facility able to convert a large variety of input forms into high-quality printed output. Work has commenced on the establishment of an experimental system to provide Member States with direct on-line access to the INIS data base stored on the Agency's computer and hence a means of searching the INIS and AGRIS files directly from computer terminals installed in the countries themselves; the terminals will be connected to the Agency's computer by telephone lines.

L.16. Under an agreement with CEC on automatic indexing, INIS has been co-operating in an experimental comparison of the effectiveness - for retrieval purposes - of computer-assigned and human-assigned index terms.

L. 17. INIS centres in participating Member States are responsible for providing national nuclear information services using the products of the system (INIS magnetic tapes, INIS ATOMINDEX and INIS microfiches). Thus, the existence of INIS is a reason for countries to develop their capabilities for disseminating information and to build up national information structures in accordance with local conditions and needs. To assist Member States in developing the specialized manpower required, INIS conducts regular training seminars, makes available opportunities for fellows and other trainees to receive in-house training at the Agency's Headquarters and provides a technical advisory service for national information centres. Over 450 people, many of them from developing countries, have undergone some form of INIS training since the system started operating.

PLANS FOR 1979-80

L. 18. It is expected that, following consultation with INIS Liaison Officers early this year, the scope of INIS will be expanded in 1979 to include the medical applications of ionizing radiation and radionuclides; it is estimated that there will be a resulting increase of 5000-8000 in the number of items processed each year.

L. 19. It is also expected that 1979 will see the introduction into INIS of a system for the ready identification of new records entering the INIS data base and describing documents which contain data. This identification system should be of particular value to users of INIS products who are unable to call upon the services of specialized data centres and who are therefore compelled to search for data in primary publications.

L. 20. The experimental on-line access system introduced in 1977-78 will probably develop in two ways - additional Member States may begin participating and Member States which have been participating from the outset may gradually replace their simple terminals by more sophisticated ones which enable a number of centres in a country to connect to the Agency's computer through a central point within the country.

L. 21. Efforts will also be made to provide participating Member States with access to additional scientific data bases through co-operative arrangements with other information systems.

L. 22. Experiments in the computer-assisted preparation of a multilingual dictionary of nuclear terminology based on the INIS Thesaurus - which is now available in French, German and Russian as well as in English, thanks to the efforts of the national INIS centres in France, the Federal Republic of Germany and the Soviet Union - are expected to result in the production of such a dictionary in 1979-80.

L. 23. The experiments in automatic indexing started in 1977-78 in co-operation with CEC will continue; the aim is eventually to reduce the large manpower costs incurred by Member States in the manual indexing of documents. It is also planned to commence experiments with programmes developed in Member States for the automatic translation of abstracts of scientific literature.

L. 24. It is expected that the successful co-operation with FAO in the processing of AGRIS data on a cost-reimbursable basis will continue.

L. 25. It is planned to hold a meeting of the Advisory Committee for INIS in 1979 (Technical Committee - Annex II (105)); the Advisory Committee will be requested to review the progress made by INIS since its last meeting, in December 1974, and be invited to make recommendations for the further development of the system.

L. 26. Two further INIS training seminars are planned, one for 1979 (Seminar - Annex I (29)) and one for 1980 (Seminar); they will probably be held in collaboration with FAO. The INIS Liaison Officers will meet in 1979 (Technical Committee - Annex II (104)) and in 1980 (Technical Committee).

L. 27. Committees of experts from Member States will be convened to advise the Agency on various aspects of INIS: in 1979, further development of the on-line access system will be considered (Technical Committee - Annex II (106)); in 1980, the improvement of INIS document services and the revision of various volumes in the INIS Reference Series will be discussed (Technical Committees).

RELATED ACTIVITIES

L. 28. Advisory services will continue to be provided and international standards for information processing will be formulated.

PLANS FOR 1981-84

L. 29. Attention will be paid to the development, within the framework of INIS, of mechanisms for more precision in the analysis of the stored information; this will permit greater refinement in the delivery of information to the user, it being recognized that an information system should deliver information which is specifically geared to the user's needs rather than swamping him with information which he does not require or which is presented in such a way that he cannot understand it. Such considerations are particularly important in the context of technology transfer, with developing countries aspiring to the same ready and selective access to the world's scientific and technical information as that which the industrialized countries have, and also in the context of the need to charge more for information services, technological changes and the growing volume of scientific and technical information.

L. 30. Stimulation of the growth and development of local infrastructure for the delivery of information within Member States will continue to be a matter of high priority; it can be achieved through improved training programmes and through co-ordinated action by the Agency and the national INIS centres aimed at cost-effectiveness in the use of new information delivery methods and techniques (particularly methods and techniques for on-line access to both documents and data).

CO-OPERATION WITH OTHER ORGANIZATIONS

L. 31. This sub-programme involves close co-operation with UNESCO, FAO, CEC, CMEA, ISO and the INIS centres of Member States.

Library services

OBJECTIVE

L. 32. The objective is to provide the Secretariat and Member States with comprehensive library-based information and document services by acquiring and maintaining a first-class collection of literature, organized on modern lines, and by stimulating and co-ordinating international co-operation among nuclear libraries.

RESULTS TO DATE

L. 33. Emphasis has continued to be on improving the services provided to users. To this end there has been some reorganization; for example, the serials collection has been reorganized to provide the Secretariat with more rapid access to the latest available

periodicals in its fields of interest. In recognition of the importance of standards literature, a separate standards collection has been established.

L. 34. A "branch library" has been established for the scientific and technical staff of the Joint FAO/IAEA Division and the Division of Life Sciences at their temporary offices.

L. 35. Records of new books and journals received by the Libraries of both the Agency and UNIDO have continued to be included in the Agency Library's machine-readable file of holdings; information products from this file are regularly distributed to Agency personnel and to libraries and individuals in Member States.

L. 36. In order to make the availability of technical report literature in the Library more widely known, titles of reports particularly pertinent to the Agency's programmes have been brought to the attention of Agency staff and of Member States through a monthly list of acquisitions.

L. 37. In anticipation of the move to the Agency's Permanent Headquarters, a centralized reference and loan service has been established on an experimental basis.

PLANS FOR 1979-80

L. 38. After the move to the Agency's Permanent Headquarters in the Donaupark, the Library will - under an agreement between the Agency, UNIDO and the United Nations - have the added responsibility of providing (on a cost-sharing basis) library services also for UNIDO and, possibly, other United Nations organizations. In this connection, the establishment of satellite collections, "branch libraries" and library service points will be considered.

L. 39. The use of automation will be extended to provide better control of the receipt of journals.

L. 40. Emphasis will be placed on further improving reference and information services - for example, through the use of on-line bibliographic data bases (the INIS data base, the Library's own data bases and possibly other data bases of relevance to Agency programmes). The current-awareness service provided at present will be made more comprehensive.

L. 41. The Library will support INIS activities aimed at assisting scientists to obtain nuclear and related literature more rapidly. To that end, a variety of techniques for rapid document delivery will be explored in close co-operation with the INIS Section and with libraries, information clearinghouses and information centres in Member States. The Library will endeavour to establish co-operative arrangements with other libraries in the nuclear field and will assist in such projects as the creation of union lists of nuclear journals.

L. 42. Short training courses on the acquisition and processing of nuclear information will be organized for librarians and information workers from Member States.

PLANS FOR 1981-84

L. 43. Once the Agency has settled in its Permanent Headquarters, the emphasis will shift to the further expansion of services - for example, through an increase in the number of library service points. The Library will seek further ways of meeting the nuclear information needs of Member States - for example, the records of the Library's holdings will be made available in a variety of forms (such as printed books and microfiches).

L. 44. Additional, more efficient methods of document delivery will be introduced as the Library continues to expand its co-operation with other nuclear libraries.

L. 45. The Library will continue to offer on-line reference services and will increase the number of data bases from which it offers computer-assisted current-awareness services. The need for an on-line system for keeping track of titles in circulation will be explored.

L. 46. The short training courses for librarians and information workers from Member States will be supplemented by a regular internship programme. The scope of the courses will be broadened to include such topics as computer-assisted information retrieval techniques in reference service and library collection development. A variety of tutorial aids will be developed.

CO-OPERATION WITH OTHER ORGANIZATIONS

L. 47. There will be co-operation with UNIDO (in planning and effecting the move to the Donaupark), with nuclear libraries in Member States, with such organizations as the International Federation of Library Associations and the International Federation for Documentation and with national library associations in Member States (in the planning of training programmes), with organizations offering on-line access to bibliographic data bases and with organizations - such as the European Association of Scientific Information Dissemination Centres - which are involved in the provision of computer-assisted information services.

Computer services

OBJECTIVE

L. 48. The objective is to provide electronic data processing services in support of INIS and Agency safeguards and of management and various other activities of the Agency and UNIDO.

RESULTS TO DATE

L. 49. A new computer, an IBM 370/158, was installed in June 1977. It is more powerful than the previous one, an IBM 370/145, and allows fast processing of safeguards data, supports the Agency's and UNIDO's computerized administrative and information systems, processes data for INIS and constitutes the basis for development of access to data by means of teleprocessing equipment.

L. 50. On-line data entry has been introduced for INIS and AGRIS, which means faster updating of their data bases. On-line information searching has also been introduced and is being widely used.

L. 51. Special terminals have been installed for the Department of Safeguards, the Nuclear Data Section, UNIDO and the Computer Section to permit the remote entry of computer jobs and the remote printout of results (remote printing now accounts for about one third of all output printing).

PLANS FOR 1979-80

L. 52. In 1979, an even more powerful computer will be installed in the Donaupark, where the Agency will provide (on a cost-sharing basis) computer services also for UNIDO and, possibly, other United Nations organizations. The introduction of extensive teleprocessing systems will give users reliable on-line access to computer-stored data and allow fast processing (the considerable work load connected with the introduction of these systems will call for an additional Professional post at the P-4 level in the Systems Programming Group - see Table L. 2 and Annex V).

L. 53. The overall demand for computer services will depend on the requirements of other United Nations organizations moving to Donaupark.

L. 54. Almost all data processing will be carried out using the ADABAS generalized data base management system.

L. 55. Training in several computer programming areas will be provided for personnel from Member States.

L. 56. It is expected that widespread use will be made of terminals in a variety of areas where cost-effectiveness can be demonstrated.

L. 57. The installation of a separate minicomputer system for such purposes as time recording and physical access control will be considered.

PLANS FOR 1981-84

L. 58. It is expected that the computer work load will continue to grow owing to a further increase in safeguards information processing and to the greater use of on-line, real-time enquiry and data up-dating methods. The establishment of fast communication links with computer centres in Member States for the transfer of data and of data processing results is envisaged.

L. 59. The exchange of computer programs between Member States and the Agency will increase and the provision of training in various computer programming areas will be expanded.

L. 60. Mass-storage devices for providing necessary on-line storage capacity and a large number of additional terminals will be installed.

CO-OPERATION WITH OTHER ORGANIZATIONS

L. 61. Co-operation with the computer centres of other United Nations organizations will be intensified.

Scientific journals

OBJECTIVE

L. 62. The objective is to foster the exchange of information on peaceful uses of atomic energy through the publication of Atomic Energy Review and to disseminate information on current research in controlled thermonuclear fusion, on technology directly relevant to fusion reactor concepts and on major fusion problems through the publication of Nuclear Fusion.

RESULTS TO DATE

L. 63. Nuclear Fusion, which is now appearing each month, has become widely recognized as the major international journal on controlled thermonuclear fusion and plasma physics; scientists working at 60 laboratories in 16 Member States (four of them developing countries) contribute to it.

L. 64. On the advice of the journal's Board of Editors, a scheme for the publication of review articles on key fusion problems has been introduced.

L. 65. The distribution and pricing policy has been revised, the number of copies distributed free being reduced and a two-tier price structure for the benefit of individual scientists being introduced in the interests of a wider dissemination of research results.

L. 66. On the advice of the International Fusion Research Council (IFRC), work has started on a "World Survey of Major Facilities in Inertial Confinement Experiments", to be published as a supplement to Nuclear Fusion this year; 27 institutes in 13 Member States are participating in the survey.

L. 67. Two international organizations and 105 institutes in Member States participated in the third "World Survey of Major Facilities in Controlled Fusion Research", published as a supplement to Nuclear Fusion in 1976.

L. 68. In the 16 years of its existence, Atomic Energy Review has carried critically evaluated information on all aspects of the peaceful uses of atomic energy. During the period 1963-77, the coverage by subjects was: nuclear chemistry - 18%; nuclear reactors and nuclear engineering - 22.7%; nuclear physics (theory and applications) - 23.2%; life sciences - 13.5%; dosimetry - 6.2%; safety, waste disposal, environmental problems and safeguards - 11.3%; and earth sciences, computer applications, nuclear facility management and space research - 5.1%.

L. 69. Preparations have been made for the publication in 1978 of two further special issues of Atomic Energy Review on the physico-chemical properties of the compounds and alloys of selected elements; they will deal with molybdenum and hafnium.

PLANS FOR 1979-80

L. 70. Both journals will continue to be published regularly.

L. 71. The supplements to Nuclear Fusion will be published in accordance with an established schedule. Following consultations with the Board of Editors, the heads of major fusion research institutes and IFRC, consideration will be given to expanding the subject scope of Nuclear Fusion to include further aspects of fusion technology.

L. 72. The series of special issues of Atomic Energy Review on the physico-chemical properties of the compounds and alloys of selected elements will be completed with a volume on titanium. Plans for the future of Atomic Energy Review will be drawn up following an assessment of the need of Member States for an Agency-published review journal in the nuclear field.

PLANS FOR 1981-84

L. 73. The activities constituting this sub-programme will continue.

L. 74. In order that Nuclear Fusion can adequately cover developments in the thermo-nuclear fusion field, the journal may start to be published in two series, one devoted to theoretical and experimental work and to general fusion reactor concepts and the other devoted to fusion technology and engineering problems.

CO-OPERATION WITH OTHER ORGANIZATIONS

L. 75. As Nuclear Fusion and Atomic Energy Review function through systems of independent referees, there is constant communication with scientific organizations and individual scientists. In the case of Nuclear Fusion, there is also close co-operation with IFRC.

M. POLICY-MAKING ORGANS

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table M. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	143 471	168 000	8 000	(20 000)	(12 000)	156 000	175 000
Overtime	30 614	5 600	400	8 700	9 100	14 700	16 500
Temporary assistance	16 941	8 800	500	5 700	6 200	15 000	23 000
Sub-total	191 026	182 400	8 900	(5 600)	3 300	185 700	214 500
Common staff costs	39 645	47 900	600	(5 000)	(4 400)	43 500	47 600
Travel	-	700	100	-	100	800	900
Common services, supplies and equipment	134 245	137 000	7 000	-	7 000	144 000	168 000
Other items of expenditure	37 580	18 000	18 000	9 000	27 000	45 000	47 000
Transfer of costs:							
Linguistic services	952 343	1 251 000	71 000	9 000	80 000	1 331 000	1 433 000
Printing and publishing services	212 246	229 000	13 000	38 000	51 000	280 000	350 000
TOTAL	1 567 085	1 866 000	118 600	45 400	164 000	2 030 000	2 261 000

SUMMARY OF MANPOWER

Table M. 2

Grade of post	Number of established posts					1980 Preliminary estimate
	1977 Adjusted	1978	1978 Adjusted	Change	1979	
D	1	1	1	-	1	1
P-5	-	-	1	-	1	1
P-4	2	2	-	-	-	-
P-2	-	-	1	-	1	1
Sub-total	3	3	3	-	3	3
GS	3	3	2	-	2	2
TOTAL	6	6	5	-	5	5

Distribution of costs between the General Conference and the Board

Table M. 3

Organization unit	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
General Conference	578 758	701 000	57 300	25 700	83 000	784 000	897 000
Board of Governors	988 327	1 165 000	61 300	19 700	81 000	1 246 000	1 364 000
TOTAL	1 567 085	1 866 000	118 600	45 400	164 000	2 030 000	2 261 000

CHANGES IN COSTS

M.1. As will be seen from Table M.1 above, the total cost of this programme is expected to increase by \$164 000 as a result of price increases of \$118 600 and a programme increase of \$45 400. The programme decrease of \$25 000 in respect of salaries for established posts and common staff costs is attributable to a redeployment of existing posts in the Adjusted Manning Table for 1978.

M.2. It is expected that programme increases will be required for overtime (\$8700) and temporary assistance (\$5700) in the light of actual requirements in 1977. The programme increase of \$9000 under "Other items of expenditure" reflects more extensive external auditing.

M.3. As regards service costs, a programme increase of \$9000 is foreseen in respect of linguistic services and one of \$38 000 in respect of printing services.

THE PROGRAMME

M.4. The responsibility for providing the services required by the policy-making organs of the Agency, namely the General Conference and the Board of Governors, is shared by the Secretariat of the Policy-making Organs, which undertakes the organizational and administrative work involved, and three Divisions in the Agency's Secretariat. The Division of Languages translates the documents and prepares records of proceedings; the Division of Publications reproduces and circulates the documents; and the Division of External Relations provides the conference and interpretation facilities and services needed for the meetings of the two organs and their committees. In all work concerning the General Conference and the Board of Governors, the Secretariat of the Policy-making Organs reports to the Director General. Certain matters related to internal administration are co-ordinated with the Head of the Department of Administration.

M.5. It is planned to provide these services throughout the period 1979-84 on the same lines as in the past, introducing such improvements as prove to be desirable in the light of further experience and the changing requirements of the policy-making organs themselves.

N. EXECUTIVE MANAGEMENT AND TECHNICAL
PROGRAMME PLANNING

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table N. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	631 220	690 000	37 000	-	37 000	727 000	790 000
Consultants	14 032	57 000	3 000	33 500	36 500	93 500	94 100
Overtime	8 745	9 800	600	200	800	10 600	10 600
Temporary assistance	-	900	100	-	100	1 000	1 200
Sub-total	653 997	757 700	40 700	33 700	74 400	832 100	895 900
Common staff costs	174 424	200 800	2 600	-	2 600	203 400	217 300
Travel	57 795	59 000	4 200	2 800	7 000	66 000	77 800
Meetings							
Technical committees, advisory groups	32 057	48 000	2 000	(2 000)	-	48 000	48 000
Representation and hospitality	22 468	23 500	-	-	-	23 500	24 000
Transfer of costs:							
Linguistic services	31 829	21 000	1 300	8 700	10 000	31 000	35 000
Printing and publishing services	10 453	9 000	500	3 500	4 000	13 000	14 000
TOTAL	983 023	1 119 000	51 300	46 700	98 000	1 217 000	1 312 000

SUMMARY OF MANPOWER

Table N. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
DG	1	1	1	-	1	1
DDG	3	3	3	-	3	3
D	1	1	1	-	1	1
P-5	1	2	2	-	2	2
P-4	-	-	1	-	1	1
P-3	3	3	2	-	2	2
P-2	2	2	2	-	2	2
P-1	1	1	1	-	1	1
Sub-total	12	13	13	-	13	13
GS	8	9	10	-	10	10
TOTAL	20	22	23	-	23	23

CHANGES IN COSTS

N. 1. As will be seen from Table N. 1 above, it is expected that the cost of this programme will increase by \$98 000, of which \$51 300 will be required to cover salary and other price increases and \$46 700 will be a programme increase.

N. 2. An increase of \$33 500 in respect of consultants' services is required mainly for the Office of the Director General. A programme reduction of \$2000 in respect of meetings reflects lower costs in connection with the Scientific Advisory Committee. A programme increase of \$2800 is foreseen in respect of duty travel.

N. 3. As regards service costs, an increase of \$8700 is foreseen for linguistic services and \$3500 for printing services.

THE PROGRAMME

OBJECTIVE

N. 4. The objective of the Office of the Director General is to propose and implement programmes within the scope of the Agency's statutory objectives, pursuant to decisions of the Board and the General Conference and on the advice of the Scientific Advisory Committee (Annex II (107 and 108)); it is also responsible for the efficient conduct and co-ordination of the Agency's work.

N. 5. The objective of the Offices of the Deputy Directors General for Research and Isotopes, for Technical Assistance and Publications and for Technical Operations is to advise and assist the Director General in matters concerning the planning and implementation of the Agency's scientific programmes; they are also responsible for the effective execution of approved programmes within their respective Departments.

O. ADMINISTRATION

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table O. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	3 152 813	3 610 000	238 000	69 000	307 000	3 917 000	4 610 000
Consultants	45 386	5 000	300	(300)	-	5 000	30 000
Overtime	11 456	7 400	400	500	900	8 300	15 600
Temporary assistance	106 082	54 000	3 300	(300)	3 000	57 000	69 000
Sub-total	3 315 737	3 676 400	242 000	68 900	310 900	3 987 300	4 724 600
Common staff costs	871 218	1 047 000	28 400	19 000	47 400	1 094 400	1 267 000
Travel	55 743	44 600	3 300	(300)	3 000	47 600	67 800
Meetings							
Conferences, symposia, seminars	21 408	-	-	15 000	15 000	15 000	-
Technical committees, advisory groups	31 335	14 000	-	(14 000)	(14 000)	-	16 000
Representation and hospitality	15 079	15 200	800	-	800	16 000	18 600
Common services, supplies and equipment	135 949	132 000	9 200	(500)	8 700	140 700	194 000
Other items of expenditure	69 302	91 800	5 200	-	5 200	97 000	104 000
Transfer of costs:							
Linguistic services	283 145	300 000	17 000	(17 000)	-	300 000	335 000
Printing and publishing services	394 791	361 000	20 500	(1 500)	19 000	380 000	435 000
Data processing services	368 271	382 000	7 500	62 500	70 000	452 000	582 000
Laboratory services	-	-	-	-	-	-	-
To other: Safeguards PNE	(118 000) (30 000)	(123 000) (34 000)	(6 000) (2 000)	-	(6 000) (2 000)	(129 000) (36 000)	(139 000) (38 000)
TOTAL	5 413 978	5 907 000	325 900	132 100	458 000	6 365 000	7 567 000

SUMMARY OF MANPOWER

Table O. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
DDG	1	1	1	-	1	1
D	6	6	6	-	6	6
P-5	14	14	14	1	15	15
P-4	13	15	15	1	16	20
P-3	13	13	14	-	14	16
P-2	11	12	12	-	12	13
P-1	3	2	2	-	2	2
Sub-total	61	63	64	2	66	73
GS	96	105	105	-	105	124
TOTAL	157	168	169	2	171	197

CHANGES IN COSTS AND MANPOWER

Costs

- O. 1. As will be seen from Table O. 1 above, it is expected that the cost of this programme will increase by \$458 000, of which \$325 900 will be required to cover salary and other price increases and \$132 100 will be a programme increase.
- O. 2. The programme increase of \$88 000 in respect of salaries for established posts and common staff costs is attributable to the addition of new posts in 1979 and to the additional cost in 1979 of posts for which funds were provided in the 1978 budget for only part of the year.
- O. 3. A programme increase of \$500 in respect of overtime is offset by decreases of \$300 each in respect of consultants' services, temporary assistance and duty travel, and \$500 in respect of common services, supplies and equipment.
- O. 4. A programme increase of \$15 000 in respect of symposia and seminars is offset by a programme decrease of \$14 000 in respect of technical committees and advisory groups; the Legal Division is planning one seminar for 1979 but no meetings in the other category.
- O. 5. As regards service costs, it is expected that the cost of meeting the need for linguistic services will decrease by \$17 000 and the need for printing and publishing services by \$1500; the cost of data processing services for the Division of Budget and Finance and the Division of Personnel is expected to increase by \$62 500.
- O. 6. Income from UNIDO in connection with the Joint Medical Service is expected to be \$120 000 in 1979.

Manpower

- O. 7. As will be seen from Table O. 2 above, the addition of two Professional posts and the reclassification of one Professional post from the P-4 to the P-5 level are foreseen for 1979. Detailed justifications are provided in Annex V.
- O. 8. For 1980, the addition of 7 Professional and 19 GS posts is foreseen.

THE PROGRAMME

OBJECTIVE

O. 9 The objective is to ensure the effective functioning of the Agency's administrative activities. The Office of the Deputy Director General for Administration is responsible for the overall direction and supervision of the internal audit and management, budget and finance, personnel, legal and external relations services, in addition to the linguistic services (see paragraphs Q. 8 to Q. 12 below) and the "General services" programme (see paragraphs P. 8-P. 15 below). Certain matters related to internal administration in respect of the Secretariat of the Policy-making Organs will be co-ordinated with the Department of Administration.

STRUCTURE

O.10. This programme consists of five sub-programmes, which are dealt with separately below.

Summary of total costs by organization unit

Table O. 3

Organization unit	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Office of the Deputy Director General for Administration	290 327	292 000	14 400	2 600	17 000	309 000	341 000
Office of Internal Audit and Management Services	249 818	333 000	15 400	(19 400)	(4 000)	329 000	414 000
Division of Budget and Finance	1 599 805	1 868 000	104 200	182 800	287 000	2 155 000	2 598 000
Division of External Relations	1 771 096	1 777 000	85 500	(13 500)	72 000	1 849 000	2 146 000
Legal Division	365 264	391 000	20 900	(38 900)	(18 000)	373 000	413 000
Division of Personnel	1 137 668	1 246 000	85 500	18 500	104 000	1 350 000	1 655 000
TOTAL	5 413 978	5 907 000	325 900	132 100	458 000	6 365 000	7 567 000

Summary of manpower by organization unit and category

Table O. 4

Organization unit	1977 Adjusted budget			1978 Adjusted budget			1979 Estimate			1980 Preliminary estimate		
	P	GS	Total	P	GS	Total	P	GS	Total	P	GS	Total
Office of the Deputy Director General for Administration	3	2	5	3	2	5	3	2	5	3	2	5
Office of Internal Audit and Management Services	5	4	9	5	4	9	5	4	9	6	5	11
Division of Budget and Finance	18	36	54	20	39	59	22	39	61	25	47	72
Division of External Relations	17	22	39	18	25	43	18	25	43	19	28	47
Legal Division	8	5	13	8	5	13	8	5	13	8	5	13
Division of Personnel	10	27	37	10	30	40	10	30	40	12	37	49
TOTAL	61	96	157	64	105	169	66	105	171	73	124	197

SUB - PROGRAMMES

Office of internal audit and management services

OBJECTIVE

O.11. The objective is to carry out an independent appraisal activity in order to assist the Director General in achieving the most effective use of the Agency's resources by:

- (a) Reviewing financial and administrative procedures and operations covering all funds and resources administered by the Agency;
- (b) Providing a management advisory service to all Departments; and
- (c) Compiling and keeping up to date the Agency's Administrative Manual and other administrative instructions.

Budget and finance services

OBJECTIVE

O.12. The objective is to develop and implement programme, budgetary and financial procedures to ensure effective financial control and the attainment of programme objectives with the most economic use of available financial resources.

PLANS FOR 1979-84

O.13. The Division of Budget and Finance will:

- (a) Maintain the financial records, prepare the Agency's accounts and provide the data required for the effective financial management of the Agency;
- (b) Be responsible for programme budgeting, to ensure effective use of resources and to facilitate planning and control of activities;
- (c) Carry out the necessary work relating to Member States' contributions to the Regular and Operational Budgets;
- (d) Be responsible for establishing financial and budgetary systems, for documenting them and for issuing related regulations and instructions to the Agency's organizational units and staff members, as appropriate;
- (e) Provide for or co-ordinate the Agency's representation at meetings of the United Nations or other international bodies on financial and budgetary matters; and
- (f) Be responsible for establishing contracting policy, administering research-oriented contracts and maintaining centralized records of Agency contracts and agreements.

O.14. The Division of Budget and Finance plans to carry out in this period the following actions in order to strengthen its present system of financial management:

- (a) Make a comprehensive and detailed study of the present accounting and budget system to provide a basis for further improvement, as necessary, of the integrity of the overall computerized system;

- (b) Review the present systems of financial control over activities outside Vienna and over extra-budgetary resources, and based on these reviews develop and implement improved systems;
- (c) Design and implement improved cost measurement systems for printing, laboratory and computer services;
- (d) Design and implement an improved payroll system; and
- (e) Establish allotment control and other improvements for the technical assistance programme.

For these activities two additional Professional posts will be required (see Table O.2 and Annex V).

CO-OPERATION WITH OTHER ORGANIZATIONS

O.15. The Division of Budget and Finance is responsible for financial execution of UNDP and UNEP projects and for reporting thereon as required. The Division co-ordinates with UNESCO with respect to the joint operation of the Trieste Centre, with FAO with respect to the financial operations of the Joint FAO/IAEA Division and the operation of AGRIS and with UNIDO in respect of common services.

Personnel services

OBJECTIVE

- O.16. The objective is:
- (a) To advise the Director General on all personnel matters and administer a personnel system which is in line with the Statute and Staff Regulations and other directives of the Board of Governors and contributes to meeting the objectives and fulfilling the functions of the Agency;
 - (b) To recruit the staff of the Secretariat in a manner that will ensure the optimum use of available manpower resources, due regard being given to the principle of widest possible geographical distribution;
 - (c) To provide staff training and welfare services;
 - (d) To prepare documentation on personnel matters for the Board of Governors and the General Conference; and
 - (e) To participate in the activities of inter-agency (e. g. CCAQ) and inter-governmental (e. g. ICSC) bodies established for the purpose of co-ordinating personnel policy within the United Nations system with a view to establishing a unified international civil service.

PLANS FOR 1979-84

O.17. In addition to administering the Agency's personnel sub-programme, including the Joint Medical Service, the Division of Personnel plans to carry out in this period the following actions in order to strengthen and improve the existing system of personnel management:

- (a) To explore new recruitment sources and develop recruitment standards in order to improve the proportion of women and persons from under-represented areas on the Agency's staff;

- (b) To introduce a training and staff development system designed to increase the effectiveness and satisfaction of staff members in their job and hence the efficiency of the Agency;
- (c) To review conditions of employment and develop improved methods of personnel management which ensure optimum utilization of human resources and better motivation of staff members, taking into account recommendations of ICSC; and
- (d) To deal with all personnel matters which will arise in connection with the move to the Permanent Headquarters, particularly in respect of the common services operated jointly with UNIDO.

Legal services

OBJECTIVE

O.18. The objective is:

- (a) To give the Director General legal advice and to provide legal services to the Secretariat relating to all matters concerning the operations of the Agency;
- (b) To collect, study and computerize information on nuclear law with a view to assisting Member States;
- (c) To carry out training of officials of Member States and to provide advisory services to Member States in nuclear law and regulatory matters;
- (d) To draft, negotiate and conclude agreements with States and other international organizations and to advise on the interpretation and application thereof, in particular with regard to safeguards agreements and the Headquarters Agreement[O. 1];
- (e) To defend the Agency's interests in contentious cases; and
- (f) To promote developments in international law which are of interest to the Agency, in particular in the field of nuclear law.

PLANS FOR 1979-84

O.19. Work will continue on the negotiation and application of safeguards agreements with Member States as well as with States which are party to NPT. Legal assistance and training will be provided to Member States which embark on nuclear fuel cycle activities for the establishment of national systems of accounting for and control of nuclear materials.

O.20. The provision of facilities and assistance to the conference to consider the drafting of a Convention on the Physical Protection of Nuclear Material will continue as required. Should a convention be adopted before the beginning of 1979, it might be necessary for there to be a revision of the Agency's recommendations contained in document INFCIRC/225/Rev. 1. The Division will also be assisting in the projected organization of training courses in physical protection and consideration of further Agency publications on the subject.

[O. 1] Reproduced in document INFCIRC/15/Rev. 1.

- O. 21. Advice and assistance will be given on the legal aspects of the international plutonium management study being carried out under Agency auspices and, as appropriate, in INFCE.
- O. 22. Advice and assistance will be given as appropriate in drawing up procedures for the provision of assistance by the Agency for PNE services requested by Member States.
- O. 23. Work will continue to encourage further acceptance of the Vienna Convention on Civil Liability for Nuclear Damage and to attain increased harmonization between the Vienna and Paris Conventions in co-operation with NEA. Preparations will be made for a review of the Vienna Convention five years after its entry into force in 1977, as provided for therein.
- O. 24. Advice and assistance will be provided as appropriate on legal arrangements for visits of nuclear merchant ships. The status and development of international conventions applicable thereto, in particular the Convention on the Liability of Operators of Nuclear Ships, will continue to be followed closely.
- O. 25. The provision of advice and assistance will continue in developing nuclear safety and environmental protection codes and guides, particularly for nuclear power plants and for the control of dumping of waste at sea.
- O. 26. The provision of advice and assistance will continue in the application of the Agency's Regulations for the Safe Transport of Radioactive Materials and the revision of radiation safety standards, codes of practice and guides established as a guidance for the legislation of Member States and in the development of new recommendations, particularly on procedures to be followed in the event of accidents during transport of radioactive materials, and on the international movement of irradiated food.
- O. 27. The drafting of international conventions which may have an impact on nuclear matters, such as the Convention on the Law of the Sea, the Convention Extending to Hazardous Substances other than Oil the Convention on Civil Liability for Oil Pollution Damage, the Convention on the Carriage of Goods by Sea, etc., will be followed closely.
- O. 28. In co-operation with NEA, efforts will continue to improve the computerization of information on nuclear law and related matters.
- O. 29. Training of officials of Member States in nuclear law and regulatory matters will be provided by means of in-service training and interregional seminars (Seminar - Annex I (30)). Assistance will continue to be provided to the technical Divisions with respect to the legal and regulatory components of interregional training courses on nuclear power projects.
- O. 30. The provision of advisory services to developing countries in the establishment of regulatory bodies on atomic energy and in the elaboration of legislation and regulations for licensing and control of nuclear installations, including third party liability provisions, has become an important part of this sub-programme and is expected to be increasingly requested by Member States in connection with the implementation of nuclear power projects.

External relations

OBJECTIVE

- O. 31. The Division's main tasks are:
- (a) To assist the Director General in the Agency's relations with Member States and with other international organizations;

- (b) To direct the negotiation of safeguards agreements, to promote the negotiation, signature and entry into force of safeguards agreements and to participate in the studies relevant to non-proliferation;
- (c) To keep the public informed of the Agency's activities through the media of newspapers, periodicals, radio, television and exhibitions; and
- (d) To provide organizational and administrative services for scientific meetings at Headquarters and other locations and to co-ordinate and provide administrative services for all other Agency meetings (the General Conference, the Board of Governors and its committees, etc.)

PLANS FOR 1979-84

O. 32. Advice will be given to the Director General and the Departments in the Secretariat on relations with Governments and with other organizations.

O. 33. In co-operation with the Legal Division, the Division will negotiate agreements in connection with safeguards and NPT and will continue the study on international plutonium management and other non-proliferation studies in connection with, for example, INFCE.

O. 34. It will compile reports for the General Conference and prepare documents for the General Conference and the Board on matters affecting the external relations of the Agency. It will also oversee and maintain the Agency's relations with the United Nations and other international bodies. It will provide visa services to the Secretariat and protocol services to the Secretariat and to Missions and Delegations.

O. 35. Through its offices at United Nations Headquarters in New York and in Geneva, permanent liaison will be maintained with the United Nations and with the Geneva-based organizations of the United Nations and with UNEP.

O. 36. Information for the general public will continue to be provided through all media. Efforts will be made to facilitate public understanding of the safety and environmental aspects of the nuclear industry and of the role of nuclear power in view of the energy situation.

O. 37. A special effort will be made to provide information on the Agency's work to selected institutions and groups, such as universities, public utilities, national federations of industry, trade unions, managers, government officials and economists. While maintaining an impartial attitude towards any controversial subjects concerning nuclear energy, the Division will publish special booklets giving factual information concerning topical problems, their solutions, past experience and promising fields of research. In particular, Member States in which nuclear power has just been introduced or is about to be introduced will be apprised of the various problems and public reactions in industrialized countries having nuclear power programmes, and the Agency's role in environmental protection will be stressed. The Agency will continue to publish the Bulletin at intervals of two months and the quarterly publication "Meetings on Atomic Energy", which gives information on meetings to be convened by the Agency as well as by other international organizers.

O. 38. The main topics in regard to which the Agency's role should continue to be publicized are the role of nuclear energy in the overall energy field, the impact of nuclear energy on the environment, the role of nuclear techniques in meeting the need for more food and safeguards and physical protection.

O.39. Because of the importance of the public acceptance issue, the Agency will become more active in providing objective factual information about nuclear power, including information on safety-related incidents. In this way, it will help to supply the background against which a balanced opinion about the pros and cons of nuclear energy can be formed. Closer co-operation with national and international institutions dealing with nuclear matters will be developed.

O.40. The servicing of the Agency's meetings both in Vienna and at locations in Member States will continue. The total number of scientific meetings now being serviced annually is around 150.

O.41. The Agency will continue sponsorship of non-Agency meetings which are of interest to the Agency's programme by providing scientific and, in some cases, organizational support. In all of these cases the Agency distributes the information concerning the meetings to all its Member States.

P. GENERAL SERVICES

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table P. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	2 148 010	2 399 000	183 000	(162 000)	21 000	2 420 000	2 790 000
Overtime	59 269	43 000	2 600	(39 600)	(37 000)	6 000	80 000
Temporary assistance	103 014	113 000	6 800	(29 800)	(23 000)	90 000	30 000
Sub-total	2 310 293	2 555 000	192 400	(231 400)	(39 000)	2 516 000	2 900 000
Common staff costs	593 556	694 800	27 900	(46 000)	(18 100)	676 700	767 700
Travel	2 248	1 000	100	-	100	1 100	3 000
Representation and hospitality	279	200	-	-	-	200	300
Common services, supplies and equipment	1 471 718	1 616 000	52 000	(172 000)	(120 000)	1 496 000	1 053 000
Permanent Headquarters, operating costs	-	-	-	1 945 000	1 945 000	1 945 000	5 300 000
Transfer of costs:							
Linguistic services	6 150	2 000	100	4 900	5 000	7 000	7 000
Printing and publishing services	123 990	156 000	9 000	-	9 000	165 000	170 000
Data processing services	7 146	2 000	-	18 000	18 000	20 000	20 000
TOTAL	4 515 380	5 027 000	281 500	1 518 500	1 800 000	6 827 000	10 221 000
Permanent Headquarters, operating costs	-	-	-	1 945 000	1 945 000	1 945 000	5 300 000
All other	4 515 380	5 027 000	281 500	(426 500)	(145 000)	4 882 000	4 921 000
TOTAL	4 515 380	5 027 000	281 500	1 518 500	1 800 000	6 827 000	10 221 000

SUMMARY OF MANPOWER

Table P. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
D	1	1	1	-	1	1
P-5	2	2	2	-	2	2
P-4	2	2	3	-	3	3
P-3	3	3	2	-	2	3
P-2	1	1	1	-	1	1
Sub-total	9	9	9	-	9	10
GS	71	71	71	-	71	71
M&O	129	129	129	-	129	129
TOTAL	209	209	209	-	209	210

CHANGES IN COSTS AND MANPOWER

Costs

P.1. As will be seen from Table P.1 above, it is expected that the cost of this programme will increase by \$1 800 000, of which \$281 500 is required to cover salary and other price increases and \$1 518 500 will be a programme increase.

P.2. The programme decrease of \$208 000 in respect of salaries for established posts and common staff costs reflects the intention to keep two existing manning table posts vacant during 1979 and to replace by contractual services in the Permanent Headquarters certain functions previously performed by staff members. Programme decreases are also foreseen in respect of overtime (\$39 600) and temporary assistance (\$29 800).

P.3. With regard to common services, supplies and equipment, \$1 945 000 is foreseen for the operating of the Permanent Headquarters in 1979 (the manner in which this figure has been arrived at is indicated below under "PLANS FOR 1979-84"). The programme decrease of \$172 000 is the result of reductions in the cost of maintaining premises and renting and maintaining furniture and equipment and of a reduction in selected items of equipment and supplies below the 1978 budget level.

P.4. As regards service costs, increases are foreseen in respect of linguistic services (\$4900) and data processing services (\$18 000).

Manpower

P.5. No changes in manpower are foreseen for 1979.

P.6. For 1980, the addition of one Professional post is foreseen.

Costs of common services, supplies and equipment

Table P. 3

	1977 Actual obligations	1978 Adjusted budget	1979 Estimate	1980 Preliminary estimate
<u>Division of General Services</u>				
Services				
Communications	491 634	587 000	650 000	625 000
Freight and transportation	61 620	61 000	92 000	54 000
Rental and maintenance of premises	103 154	183 000	132 000	20 000
Utilities	474 156	390 000	384 000	-
Rental and maintenance of furniture and equipment	40 329	162 000	37 000	42 000
Other	6 101	2 000	3 000	3 000
Sub-total	1 176 994	1 385 000	1 298 000	744 000
Supplies				
Building and maintenance supplies	102 660	38 000	40 000	12 000
Office supplies	89 621	93 000	90 000	150 000
Expendable equipment	32 158	56 000	30 000	50 000
Other	4 198	5 000	5 000	5 000
Sub-total	228 637	192 000	165 000	217 000
Equipment				
Building, property and maintenance equipment	2 153	4 000	3 000	-
Office furniture and equipment	49 902	29 000	20 000	75 000
Transportation equipment	6 304	6 000	10 000	17 000
Other	7 728	-	-	-
Sub-total	66 087	39 000	33 000	92 000
	1 471 718	1 616 000	1 496 000	1 053 000
Permanent Headquarters, operating costs	-	-	1 945 000	5 300 000
TOTAL	1 471 718	1 616 000	3 441 000	6 353 000

THE PROGRAMME

OBJECTIVE

P. 7. The objective is to ensure the provision of engineering, architectural and maintenance services for the Headquarters buildings, the Seibersdorf Laboratories, the Monaco Laboratory and the Trieste Centre, to provide purchasing and supply services, transportation services, security services, registry and messenger services, housing and other staff services, and to operate the Agency's commissary and restaurant until the move to the Permanent Headquarters, and thereafter to ensure the efficient operation of these common services; further, to provide all the technical, organizational and staff services required for the smooth operation of the Secretariat.

PLANS FOR 1979-84

P. 8. In addition to its regular tasks the Division of General Services will ensure the efficient and economical functioning of the Agency's new Permanent Headquarters in the

Donaupark, in co-operation with the United Nations and UNIDO. During the transitional period, before the move to the Donaupark, the Division will:

- (a) Continue the negotiations with the relevant governmental and municipal authorities, and with the planners, builders and suppliers involved in the completion of the Donaupark complex;
- (b) Be responsible for the planning and procurement of furniture, fixtures, technical and electronic equipment;
- (c) Be in charge of the planning, establishing and future operation of a large Commissary which will serve the great majority of the international community in Vienna;
- (d) Participate in the organization and co-ordination of the common services with the United Nations and UNIDO;
- (e) Be in charge of planning the allocation of office space and other working areas; and
- (f) Organize and carry out the transfer of the Secretariat to the Permanent Headquarters premises.

P.9. The transfer of the Secretariat to the Permanent Headquarters in the Donaupark will be the major activity under this programme in 1979.

P.10. The Agency has been informed by the Austrian authorities that the offices and other facilities will be ready for occupancy by the Agency in mid-1979. It is assumed that the Agency will take over two office buildings (A-1 and A-2), and make use of one half of the common services buildings and 30% of the international conference building.

P.11. The maintenance and operating costs for a period of six months have been estimated at \$1 945 000 on the basis of a net floor space figure of 89 000 m² made up as follows:

Office buildings A-1 and A-2	100% of 50 000 m ²
Common services buildings	50% of 60 000 m ²
International conference building	30% of 30 000 m ² .

P.12. It is assumed that during the initial period of occupancy no major repair, maintenance or façade and window cleaning activities will be necessary. Moreover, the 15% provision for contingencies included in maintenance and operating cost estimates made in 1976 has been omitted.

P.13. Utility charges are based on information received from IAKW (Internationales Amtssitz- und Konferenzzentrum Wien, AG) and updated in accordance with price level changes since the previous estimates were made.

P.14. All maintenance and service costs, including the fixed charges for telephone and telex services, have been taken into account, as has the cost of materials for routine repairs, maintenance and workshop operations and of services provided by outside contractors; the cost of cleaning services to be provided by outside contractors has been estimated on the basis of current rates. The annual cost of equipment and installation maintenance by outside contractors has been taken as about 3% of the purchase price of the items in question.

P.15. A breakdown by major cost component and area of the estimated maintenance and operating costs for a period of six months is given below:

	Office buildings	Common services buildings	International conference building	Total
	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Heating and cooling	260 000	174 000	23 000	457 000
Water, sewage and refuse disposal	20 000	22 000	2 000	44 000
Electricity	245 000	293 000	39 000	577 000
Telephone and telex	14 000	2 000	1 000	17 000
Cleaning	195 000	160 000	15 000	370 000
Maintenance services	220 000	223 000	37 000	480 000
TOTAL	<u>954 000</u>	<u>874 000</u>	<u>117 000</u>	<u>1 945 000</u>

Q. SERVICE ACTIVITIES

THE PROGRAMME

Q. 1. This programme consists of the two sub-programmes which are dealt with separately below. Since each sub-programme is solely concerned with the provision of services in support of the Agency's functional programmes, the total cost in each case is entirely apportioned between those programmes which require the services.

SUB-PROGRAMMES

Linguistic services

COSTS OF THE SUB-PROGRAMME

Summary by items of expenditure: Table Q. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	1 822 522	2 112 000	127 000	-	127 000	2 239 000	2 440 000
Overtime	13 723	30 500	2 000	1 000	3 000	33 500	37 000
Temporary assistance	603 427	838 000	41 000	(153 000)	(112 000)	726 000	1 061 000
Sub-total	2 439 672	2 980 500	170 000	(152 000)	18 000	2 998 500	3 538 000
Common staff costs	503 614	612 200	14 900	-	14 900	627 100	670 500
Travel	-	1 300	100	-	100	1 400	1 500
Scientific and technical contracts	5 230	70 000	4 900	2 100	7 000	77 000	80 000
Transfer of costs:							
Linguistic services	(2 948 516)	(3 666 000)	(190 000)	145 000	(45 000)	(3 711 000)	(4 297 000)
Printing and publishing services	-	2 000	100	4 900	5 000	7 000	7 000
TOTAL	-	-	-	-	-	-	-

SUMMARY OF MANPOWER

Table Q. 2

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
D	1	1	1	-	1	1
P-5	6	6	5	-	5	5
P-4	16	16	15	-	15	16
P-3	23	23	25	-	25	26
P-2	1	1	-	-	-	-
Sub-total	47	47	46	-	46	48
GS	38	38	38	-	38	39
M&O	1	1	1	-	1	1
TOTAL	86	86	85	-	85	88

CHANGES IN COSTS AND MANPOWER

Costs

Q. 2. As will be seen from Table Q. 1 above, the total cost of the linguistic services will be charged to the programmes for which those services are provided. The cost of this sub-programme is expected to increase by \$45 000, as a net result of salary and other price increases of \$190 000 partly offset by the programme decrease of \$145 000.

Q. 3. Programme increases are foreseen in respect of overtime (\$1000) and contractual translation services (\$2100). It is expected that a programme reduction of \$153 000 will be possible in respect of temporary assistance by restricting free-lance interpretation for scientific meetings.

Q. 4. It is expected that there will be a programme increase of \$4900 in respect of printing service requirements.

Manpower

Q. 5. As will be seen from Table Q. 2 above, no additional manpower is foreseen for 1979.

Q. 6. For 1980, the addition of two Professional posts and one GS post is foreseen.

STRUCTURE

Q. 7. This sub-programme consists of two components, which are dealt with below.

Summary of costs by programme component

Table Q. 3

Programme component	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Interpretation services	634 795	1 078 000	46 000	(160 000)	(114 000)	964 000	1 180 000
Translation and records services	2 313 721	2 588 000	144 000	15 000	159 000	2 747 000	3 117 000
Sub-total	2 948 516	3 666 000	190 000	(145 000)	45 000	3 711 000	4 297 000
<u>Less:</u>							
Transfer to other programmes	(2 948 516)	(3 666 000)	(190 000)	145 000	(45 000)	(3 711 000)	(4 297 000)
TOTAL	-	-	-	-	-	-	-

Linguistic services: Breakdown of costs by programme

Table Q. 4

	1977 Actual obligations	1978 Adjusted budget	1979 Estimate	1980 Preliminary estimate
Technical assistance	157 821	182 000	218 000	233 000
Nuclear power and reactors	147 832	128 000	140 000	200 000
Nuclear safety and environmental protection	296 020	244 000	258 000	298 000
Nuclear explosions for peaceful purposes	5 153	37 000	14 000	10 000
Food and agriculture	63 326	104 000	109 000	145 000
Life sciences	71 543	44 000	45 000	75 000
Physical sciences	69 300	71 000	77 000	92 000
The Laboratory	18 450	8 000	9 000	10 000
International Laboratory of Marine Radioactivity	-	1 000	-	-
Safeguards	75 233	140 000	154 000	166 000
Information and technical services	49 116	122 000	95 000	121 000
Policy-making organs	952 343	1 251 000	1 331 000	1 433 000
Executive management and technical programme planning	31 829	21 000	31 000	35 000
Administration	283 145	300 000	300 000	335 000
General services	6 150	2 000	7 000	7 000
Service activities	2 560	2 000	6 000	6 000
Charges to meetings in various programmes	718 695	1 009 000	917 000	1 131 000
TOTAL	2 948 516	3 666 000	3 711 000	4 297 000

Interpretation

Q. 8. Depending on the character and scope of any meeting held or sponsored by the Agency, simultaneous interpretation from and into four languages may have to be provided for it. The order English, French, Russian and Spanish reflects the frequency of use of these four languages; in addition, German is occasionally required. The interpretation services are also called upon from time to time to assist members of the staff in their day-to-day work by providing consecutive interpretation for meetings of small groups, informal conversations and the like.

Q. 9. The work of the interpretation services is expected to increase in the years immediately ahead, owing to an increase in the number of meetings.

Translation and records

Q. 10. By far the greatest part of the translation work in the Secretariat is from and into English, French, Russian and Spanish (the four working languages), with some translation

from and into German and less from other languages. The material translated consists of the many different types of document prepared throughout the Secretariat or received from outside for meetings held or sponsored by the Agency, the records and reports of those meetings, proceedings and other documents for publication, correspondence and working papers of all kinds required by the staff for their day-to-day work.

Q. 11. In so far as records are concerned, their provisional versions are drafted by the linguistic staff. This staff also provides advice on linguistic matters to the Secretariat as a whole and types a considerable proportion of the material to be printed by the Agency, the remainder being handled by the publishing services.

Q. 12. These activities are expected to increase in the years immediately ahead, owing to an expansion of various programmes of the Agency.

Printing and publishing services

COSTS OF THE SUB-PROGRAMME

Summary by items of expenditure: Table Q. 5

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Salaries and wages							
Established posts	1 720 151	2 020 000	131 000	-	131 000	2 151 000	2 380 000
Consultants	62	-	-	-	-	-	-
Overtime	31 616	25 500	1 300	200	1 500	27 000	31 500
Temporary assistance	115 556	53 000	3 000	(1 000)	2 000	55 000	60 000
Sub-total	1 867 385	2 098 500	135 300	(800)	134 500	2 233 000	2 471 500
Common staff costs	475 324	585 300	16 000	-	16 000	601 300	654 800
Travel	2 995	3 000	200	(200)	-	3 000	3 500
Representation and hospitality	-	200	-	-	-	200	200
Scientific and technical contracts	-	5 000	300	(300)	-	5 000	5 000
Common services, supplies and equipment	1 006 784	953 000	57 500	92 000	149 500	1 102 500	1 276 000
Transfer of costs:							
Linguistic services	2 560	2 000	100	3 900	4 000	6 000	6 000
Printing and publishing services	(3 302 066)	(3 609 000)	(196 000)	(71 000)	(267 000)	(3 876 000)	(4 340 000)
Data processing services	32 602	62 000	1 600	(13 600)	(12 000)	50 000	53 000
TOTAL	85 584	100 000	15 000	10 000	25 000	125 000	130 000

SUMMARY OF MANPOWER

Table Q. 6

Grade of post	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
D	1	1	1	-	1	1
P-5	1	1	1	-	1	1
P-4	-	-	1	-	1	1
P-3	5	5	4	-	4	4
P-2	8	8	8	-	8	10
Sub-total	15	15	15	-	15	17
GS	102	108	108	-	108	110
M&O	14	14	14	-	14	14
TOTAL	131	137	137	-	137	141

CHANGES IN COSTS AND MANPOWER

Costs

Q. 13. As will be seen from Table Q. 5 above, the cost of printing and publishing services will be charged to the programmes for which services are provided, except the reimbursable services provided for UNIDO under the IAEA/UNIDO services agreement, which remain as a charge against this sub-programme.

Q. 14. The total cost of this sub-programme is expected to increase by \$292 000, of which \$211 000 will be required to cover salary and other price increases and \$81 000 will be a programme increase.

Q. 15. The programme increase of \$92 000 in respect of common services, supplies and equipment is attributable to the inclusion of the costs of maintaining the Agency's photo-composition equipment and to the provision for replacement of one item of obsolete printing equipment.

Q. 16. The increase of \$3900 in respect of linguistic services is partly offset by reductions in respect of temporary assistance, travel and contractual services. In the light of actual requirements in 1977, a programme decrease of \$13 600 is foreseen in respect of data processing services.

Q. 17. The amount of \$71 000 which appears as a programme reduction in respect of printing and publishing services reflects the increased allocation of costs to other programmes.

Q. 18. It is expected that the income from the sale of publications, not including INIS and CINDA publications, will amount to \$545 000 in 1979. Income from UNIDO for printing services is expected to be \$125 000.

Manpower

Q. 19. No changes in manpower are foreseen for 1979.

Q. 20. For 1980, the addition of two Professional and two GS posts is foreseen.

STRUCTURE

Q. 21. This sub-programme consists of two components, which are dealt with below.

Summary of costs by programme component

Table Q. 7

Programme component	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Printing services	2 516 341	2 647 000	160 500	109 500	270 000	2 917 000	3 285 000
Publishing services	871 310	1 062 000	50 500	(28 500)	22 000	1 084 000	1 185 000
Sub-total	3 387 651	3 709 000	211 000	81 000	292 000	4 001 000	4 470 000
<u>Less:</u>							
Transfer to other programmes	3 302 066	3 609 000	196 000	71 000	267 000	3 876 000	4 340 000
Reimbursable services rendered to UNIDO	85 585	100 000	15 000	10 000	25 000	125 000	130 000

Printing and publishing services: Breakdown of costs by programme

Table Q. 8

	1977 Actual obligations	1978 Adjusted budget	1979 Estimate	1980 Preliminary estimate
Technical assistance	63 526	47 000	85 000	80 000
Nuclear power and reactors	486 899	436 000	460 000	450 000
Nuclear safety and environmental protection	276 352	356 000	435 000	445 000
Nuclear explosions for peaceful purposes	9 725	20 000	2 000	30 000
Food and agriculture	224 344	259 000	280 000	315 000
Life sciences	193 295	246 000	97 000	290 000
Physical sciences	309 857	402 000	475 000	550 000
The Laboratory	6 063	17 000	15 000	15 000
International Centre for Theoretical Physics	114 024	150 000	160 000	200 000
International Laboratory of Marine Radioactivity	1 207	3 000	3 000	3 000
Safeguards	46 120	150 000	160 000	95 000
Information and technical services	623 282	678 000	724 000	736 000
Policy-making organs	212 246	229 000	280 000	350 000
Executive management and technical programme planning	10 453	9 000	13 000	14 000
Administration	394 791	361 000	380 000	435 000
General services	123 990	156 000	165 000	170 000
Service activities	-	2 000	7 000	7 000
Charges to meetings in various programmes	205 892	88 000	135 000	155 000
Transfer of costs to other programmes	3 302 066	3 609 000	3 876 000	4 340 000
Reimbursable services	85 584	100 000	125 000	130 000
TOTAL	3 387 650	3 709 000	4 001 000	4 470 000

Printing services

Objective

Q. 22. The objective is to provide reproduction and distribution facilities to meet the requirements of the General Conference, the Board, the Secretariat (including the publications programme and INIS) and UNIDO and other international organizations on a reimbursable basis.

Plans for 1979-80

Q. 23. The volume of printing work will be determined by the activities of the Agency, UNIDO and other United Nations organizations. The increase in work resulting from the formation of the new common services will clearly have an impact on the Division of Publications' activities. Within this framework, the usual reproduction demands resulting from the General Conference, the Board of Governors and its committees will have to be met, together with the printing requests resulting from the Agency's scientific programmes. The increased output required will not be achieved without the replacement of certain old equipment and the expansion of the staff and facilities.

Plans for 1981-84

Q. 24. The printing services will continue to make the necessary adjustments to cope with the changed conditions of work and the increased work load.

Publishing services

Objective

Q. 25. The objective is to prepare, publish and distribute Agency publications and publications produced in collaboration with other international organizations. About 1000 copies of each publication are provided free of charge to Member States; additional copies are put on sale and the revenues help to cover publication costs.

Plans for 1979-80

Q. 26. The Division of Publications will publish the proceedings of the scientific meetings listed elsewhere in this document, as well as other books and journals reflecting the work of the Agency's scientific programmes. In this period, the large number of reports stemming from the NUSS project, each published in four languages, will result in an additional burden. The output of edited books, proceedings of symposia, conferences and seminars, technical committees and working groups, proceedings of scientific meetings at the Trieste Centre and journals (Nuclear Fusion and Atomic Energy Review) will probably be in the range of 20 000 to 25 000 pages per year in 1979 and 1980. In addition, the Division will publish about 20 000 pages per year for INIS and CINDA.

Q. 27. A continuous effort will be made to distribute and sell Agency publications as extensively as possible. The trend towards direct sales to areas previously covered by sales agents should result in higher revenue. It is planned to streamline the sales operations by the installation of modern office equipment. A comprehensive publications catalogue, which is issued every second year, will be published in 1980.

Plans for 1981-84

Q. 28. The publications programme will continue to reflect the scientific work of the Agency.

R. TRANSFER OF THE AGENCY TO ITS
PERMANENT HEADQUARTERS

COSTS OF THE PROGRAMME

Summary by items of expenditure: Table R. 1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978				1979 Estimate	1980 Preliminary estimate
			Price	Programme	Transfer to Permanent Headquarters	Total		
Common services, supplies and equipment	1 932 667	900 000	-	-	1 179 000	1 179 000	2 079 000	-
TOTAL	1 932 667	900 000	-	-	1 179 000	1 179 000	2 079 000	-

SUMMARY OF ESTIMATED AGENCY COSTS BY MAJOR CATEGORY

Table R. 2

Item	1977	1978	1979				Total estimate
	Adjusted original estimate ^{a/}	Adjusted original estimate ^{a/}	Adjusted original estimate ^{a/}	Common services	New requirements	Total 1979 request	
Office furniture	147 000	146 000	100 000	-	-	100 000	393 000
Library equipment	102 000	79 000	84 000	40 000	-	124 000	305 000
Simultaneous interpretation	1 094 000	-	-	-	-	-	1 094 000
Sound transmission of proceedings from conference rooms	124 000	-	-	-	8 000	8 000	132 000
Conference room furniture	575 000	96 000	-	-	-	-	671 000
Registry equipment	62 000	45 000	-	-	-	-	107 000
Beverage stations and service facilities	-	51 000	-	-	-	-	51 000
Special video equipment	214 000	-	-	-	-	-	214 000
Projection equipment	203 000	-	-	-	-	-	203 000
Purchase and supply storage equipment	17 000	-	23 000	20 000	-	43 000	60 000
Restaurant and kitchen equipment	688 000	174 000	(125 000)	431 000	-	306 000	1 168 000
Wired intercom and alarm system	152 000	-	-	14 000	40 000	54 000	206 000
Security surveillance system	28 000	-	28 000	26 000	-	54 000	82 000
Direction and other signs	85 000	-	-	11 000	-	11 000	96 000
Engineering, building management and maintenance equipment	34 000	23 000	39 000	48 000	-	87 000	144 000
Commissary	79 000	28 000	85 000	96 000	-	181 000	288 000
Lounges with refreshment area	-	-	74 000	-	-	74 000	74 000
Medical	-	124 000	-	-	-	-	124 000
Moving costs	-	56 000	282 000	-	-	282 000	338 000
Unforeseen	176 000	78 000	-	38 000	-	38 000	292 000
Sub-total	3 780 000	900 000	590 000	724 000	48 000	1 362 000	6 042 000
Additional moving costs	-	-	215 000	-	-	215 000	215 000
Installation costs	-	-	350 000	-	-	350 000	350 000
Modification costs	-	-	-	-	152 000	152 000	152 000
TOTAL	3 780 000	900 000	1 155 000	724 000	200 000	2 079 000	6 759 000

^{a/} The original cost estimate set forth in the 1977 budget and foreseen to be funded over three years has been adjusted only for the change in the exchange rate from S 18,50 to the US dollar to an exchange rate of S 16,40; except for additional moving costs and installation costs not provided in the original estimate.

R. 1. A full description of the facilities, detailed cost estimates and justifications relating to the Agency's transfer to its Permanent Headquarters were included in the budget document for 1977 (GC(XX)/567, paras S. 1 to S. 34). The budget document for 1978 contains a brief description of and cost estimates for the various items required in 1978.

R. 2. The Agency has been informed by the Austrian authorities that the offices and facilities at the Donaupark will be ready for occupancy in the summer of 1979. It is assumed that in the latter part of 1979 the Agency will take over two office buildings (Office Tower A-1 and Office Tower A-2), and make use of one half of the common services buildings and 30 per cent of the conference building.

R. 3. Taking these assumptions into consideration, requirements at the Permanent Headquarters have been reviewed. The review has indicated that the estimates presented in the 1977 budget are still valid; however, it became necessary to adjust the financial estimates due to currency instability (an exchange rate ranging from S 18.50 to S 16.40 to the United States dollar). The taking over of a second office building, which was not foreseen at the time the budget estimates for 1977 and 1978 were prepared, entails some additional requirements and a change in the sharing ratio of certain common services facilities between the Agency and UNIDO (the Agency share increasing from 33¹/₃ per cent to 50 per cent). Also additional moving costs and installation costs not previously provided for will have to be met in 1979. Accordingly, the total 1979 estimate as set forth in the above table is \$2 079 000. Additional details are furnished in the following paragraphs.

DETAILS OF EQUIPMENT AND COST

(A) OFFICE FURNITURE..... \$100 000

R. 4. The total initial request, adjusted to an exchange rate of S 16.40 to the United States dollar, amounts to \$468 000 for the years 1977 through 1979. The portion of the original estimate which is foreseen as being applicable to 1979 amounts to \$100 000 after a reduction of \$75 000 from the original estimate of \$175 000.

R. 5. No additional furniture is foreseen for 1979 for the second office tower to be taken over by the Agency.

(B) LIBRARY EQUIPMENT..... \$124 000

R. 6. The total initial request, adjusted to an exchange rate of S 16.40 to the United States dollar, amounts to \$265 000. It was foreseen that \$84 000 would be requested in the 1979 budget. The budget for 1977 (GC(XX)/567, para. S. 16) provided for the Agency to bear one third of the cost for the documents storage area. The cost-sharing ratio has now changed to 50:50, so that there will be an additional requirement of \$40 000 in 1979.

(C) SOUND TRANSMISSION OF PROCEEDINGS..... \$ 8 000

R. 7. The original request for this item was funded in the 1977 budget. To meet the needs of the second office building, it is planned to connect about 16 additional listening points with the central distribution point in the conference building at an estimated cost of \$8000.

(D) PURCHASE AND SUPPLY STORAGE.....\$ 43 000

R.8. The total initial request, adjusted to an exchange rate of S 16.40 to the United States dollar, amounts to \$40 000. The part of the expenditure which it was foreseen would be incurred during 1979 was \$23 000. The impact of the change in the cost-sharing ratio is an additional \$20 000.

(E) RESTAURANT AND KITCHEN EQUIPMENT..... \$ 306 000

R.9. The total initial request, adjusted to an exchange rate of S 16.40 to the United States dollar, amounting to \$862 000 is decreased by \$125 000. This budget request is solely attributable to the change in the cost-sharing ratio, and reflects the adjustment made in respect of previous years' funding.

(F) WIRED INTERCOM, LOUDSPEAKER AND ALARM SYSTEM.. \$ 54 000

R.10. The initial request, adjusted for currency exchange rate instability, amounts to \$152 000 and was funded in the 1977 budget. The additional cost for the installation of a system in the second office building amounts to \$40 000 and the change due to the new cost-sharing ratio for common services facilities amounts to \$14 000.

(G) SECURITY SURVEILLANCE SYSTEM..... \$ 54 000

R.11. The initial request, adjusted for currency exchange rate instability, amounts to \$54 000 of which \$28 000 was foreseen for 1979. Because of the larger Agency share in the cost of common services facilities, an additional \$26 000 will be needed in 1979.

(H) DIRECTION AND OTHER SIGNS..... \$ 11 000

R.12. The initial request, as adjusted, amounts to \$85 000 and was funded in the 1977 budget. The 1979 request relates to the Agency's increased share for common services facilities in an amount of \$11 000.

(I) ENGINEERING AND BUILDING MANAGEMENT..... \$ 87 000

R.13. The initial request, as adjusted, amounts to \$96 000, of which \$39 000 was foreseen for 1979. The additional requirement for 1979 resulting from the change in the Agency's share of the cost of common services facilities is \$48 000.

(J) COMMISSARY..... \$181 000

R.14. The initial request, as adjusted, amounts to \$192 000, of which \$85 000 was foreseen for 1979. The additional 1979 requirement of \$96 000 results from the increase in the Agency's share of the cost of common services facilities.

(K) LOUNGES AND REFRESHMENT AREAS..... \$ 74 000

R.15. The initial request, as adjusted, amounts to \$74 000 and was intended to be included in the 1979 budget. The occupancy of the second office building has no cost impact on this item.

(L) ADDITIONAL COST OF MOVING.....\$ 215 000

Printing plant	\$190 000
Hydrology Laboratory	\$ 10 000
Computer equipment	\$ 15 000

R.16. The initial request, adjusted to an exchange rate of S 16.40 to the United States dollar, for the move of the Secretariat of the Agency to the Permanent Headquarters amounts to \$338 000.

R.17. Additional funds are requested for 1979 to meet the cost of moving equipment, machines and stock items required for the printing plant, the Hydrology Laboratory and the Computer Section. Most of the heavy equipment and machines require dismantling prior to transport, and assembling prior to reinstallation.

R.18. Authorized representatives of the manufacturers will have to be present during all work involving dismantling and assembling.

R.19. On the basis of an extrapolation of the costs of in-house moves in previous years and the rearrangement of the larger part of the printing plant the following estimates have been made:

- (a) Printing facilities, including book and document stores (\$190 000). By far the most items of existing equipment and machines which will be put into use at the printing plant in the Donaupark require dismantling before transportation and assembling before reinstallation. Until the move to the Donaupark, the printing facilities will continue to be located in the basement of the temporary headquarters and in the Hofburg.

The major items of equipment to be moved from the temporary headquarters are vertical and horizontal cameras, large printing presses, a paper cutter, pneumatic collating machines and envelope-stuffing machines, a number of smaller offset presses and numerous other items of reproduction machines. The estimate for these items - for dismantling, transport, assembling and reinstallation - is \$73 000.

The transfer from the Hofburg of existing equipment belonging to the Agency and UNIDO which is to be merged at the printing plant also involves dismantling, transport, assembling and reinstallation. The items to be transferred include heavy offset machines, a paper cutter, a three-knife trimmer, a folding machine, book-binding equipment, a pneumatic collating machine and numerous smaller items of equipment. The cost of this portion of the move is estimated at \$92 000.

Also to be moved are the stocks of printing paper, reproduction supplies, publications, official documents and records, original printing plates and preprinted stencils; this will involve the dismantling and reinstallation of metal and wooden shelving. The cost of this portion of the move is estimated at \$25 000.

- (b) Hydrology Laboratory

A provision of \$10 000 is included in the estimates for 1979 for the move of scientific equipment such as liquid scintillation counters and a mass-spectrometer from the basement of the temporary headquarters to the Agency's Permanent Headquarters. The estimate is \$10 000.

- (c) Computer equipment

The estimated cost for the move of electronic data processing equipment is \$15 000. The estimate excludes the cost of the move of a rented central processing unit. It is planned to replace the machine rented now by a new configuration at the Donaupark. The estimate is \$15 000.

(M) INSTALLATION COST..... \$350 000

Computer Services	\$275 000
Hydrology Laboratory	\$ 75 000

R.20. The initial request does not provide for funds needed to meet the cost of establishing the Computer Section and the Hydrology Laboratory at the Agency's Permanent Headquarters; both will be located in the common services area. Their establishment involves installation work for which the Agency must meet the cost.

(a) Computer Services (\$275 000)

In respect of the requirements connected with the establishment of the Computer Services, IAKW has agreed to provide at its own expense the essential number of transformers for the electricity supply from the municipal system and the connecting cables at different voltages for various areas.

The additional requirement for the installation of cables from the main distribution points to individual items of equipment and the requirement for safety fuses have been established on the basis of the existing computer facilities at the temporary headquarters. The cost of these items, to be installed within the computer area, is estimated at \$110 000.

Special coaxial cables are needed for the connection of the central processing unit with on-line teleprocessing terminals at remote locations. Such cables are not provided by the building contractor and their cost must consequently be borne by the Agency. On the basis of foreseeable needs, the request for this item amounts to \$40 000.

With a view to continuing the use of the existing remote job entry systems and the planned expansion of teleprocessing for safeguards, INIS, UNIDO, AGRIS, etc., it is necessary to install a distribution and central control unit between the central processing unit and the on-line processing equipment. For a distribution and central control unit allowing for about 50-60 connections, the estimate based on information given by a supplier is \$100 000.

The cost of electrical wiring and of installing the required equipment is estimated at \$25 000.

(b) Hydrology Laboratory (\$75 000)

Special furniture and installations are required for setting up the Hydrology Laboratory. A review of requirements for the various laboratory rooms indicated that the cost would be \$75 000; the breakdown is shown below:

Electronics room	\$ 6 000
Chemical analysis room	13 000
Gas preparation room	7 000
Mass-spectrometer room	3 000
Electrolysis room	18 000
General purposes and storage	13 000

For special installations for water, electricity, gas, fume cupboards, mass spectrometers and vacuum lines, an amount of \$15 000 is required.

(N) ADAPTATION COSTS..... \$152 000

R.21. For the adaptation of Office Tower A-2 for use by the Agency, a sum of \$152 000 is required. This amount was agreed upon in negotiations with the Austrian authorities.

S. RESERVE FUNDS FOR THE ADJUSTMENT OF
PROGRAMME COST ESTIMATES

Table S.1

Item of expenditure	1977 Actual obligations	1978 Adjusted budget	Increase or (decrease) from 1978			1979 Estimate	1980 Preliminary estimate
			Price	Programme	Total		
Reserve funds for the adjustment of programme cost estimates	-	-	4 342 000	-	4 342 000	4 342 000	4 808 000
TOTAL	-	-	4 342 000	-	4 342 000	4 342 000	4 808 000

CHANGES IN COSTS

S. 1. The cost estimates made in the earlier part of this programme budget are based on a rate of exchange of 16.40 Austrian schillings to the United States dollar. However, in the light of current uncertainty about future changes in this exchange rate and with a view to avoiding a supplementary budgetary appropriation, an amount of \$4 342 000 is provided under this heading. The amount will cover expenditure increases calculated on the basis of an exchange rate of 15.05 schillings to the dollar.

S. 2. As provided in paragraph 3 of draft resolution A, Regular Budget appropriations for 1979, contained in Annex VII, reserve funds appropriated for the adjustment of programme cost estimates shall be used only with the prior approval of the Board of Governors.

A N N E X I

CONFERENCES, SYMPOSIA AND SEMINARS IN 1979

Within the limits of the appropriations and subject to the requirements of the individual programmes as outlined for 1979, it is planned to hold the meetings listed below. All meetings were considered by the Scientific Advisory Committee. The reference following each meeting is to the relevant paragraph in the programme.

Nuclear power and reactors

1. Symposium on uranium evaluation and mining techniques B. 51
2. Seminar on quality in nuclear fuel technology for countries in the Latin American region B. 75
3. Symposium on manpower requirements and development for nuclear power programmes B. 136
4. Seminar on operation and maintenance of nuclear power plants in developing countries B. 104
5. Symposium on fast reactor physics B. 218

Nuclear safety and environmental protection

6. Symposium on occupational exposure in nuclear facilities C. 21
7. Seminar on practical implications of ICRP's new recommendations C. 22
8. Symposium on the underground disposal of radioactive waste C. 98
9. Seminar on reducing occupational exposures to the lowest reasonably achievable levels for countries in the Mediterranean and Middle East region C. 22

Food and agriculture

10. Regional seminar on the use of isotope and radiation techniques in soil and water conservation studies for developing countries in the African region E. 31
11. FAO/IAEA symposium on the use of isotopes for research on and control of vectors of animal diseases, host-pathogen relationships and the environmental impact of control procedures E. 93 and E. 104

Life sciences

12. Symposium on biological implications of radionuclides released from nuclear industries F. 146
13. Seminar on nuclear-based methods for the biological monitoring of trace element pollutants F. 160

Physical sciences

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|-----|---|--------|
| 14. | Symposium on the physics and chemistry of fission | G. 19 |
| 15. | Symposium on the thermodynamics of nuclear materials | G. 90 |
| 16. | Seminar on isotope techniques in water resources development for developing countries in the African region | G. 101 |

International Centre for Theoretical Physics

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|-----|--|-------|
| 17. | Winter college on atoms and lasers | I. 16 |
| 18. | Spring college on plasma physics | I. 37 |
| 19. | Summer college on solar energy | I. 40 |
| 20. | Autumn college on the geophysics and physics of the desert | I. 44 |
| 21. | Topical meeting on high-energy physics | I. 21 |
| 22. | Solid state workshop | I. 13 |
| 23. | College on physics teaching (in French) | I. 49 |
| 24. | Workshop on applicable mathematics | I. 27 |
| 25. | Marcel Grossmann meeting | I. 23 |

Safeguards

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|-----|--|-------|
| 26. | Basic training seminar for States' systems of accounting for and control of nuclear materials (SSACs) | K. 62 |
| 27. | Advanced training seminar for States' systems of accounting for and control of nuclear materials (SSACs) | K. 62 |
| 28. | Workshop on the processing and evaluation of safeguards information | K. 74 |

Information and technical services

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| 29. | INIS/AGRIS training seminar | L. 26 |
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Administration

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| 30. | Interregional seminar on nuclear law and safety regulations for countries of Africa and the Middle East | O. 29 |
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A N N E X II

TECHNICAL COMMITTEES AND ADVISORY GROUPS IN 1979

Within the limits of the appropriations and subject to the requirements of the individual programmes as outlined for 1979, it is planned to hold the meetings listed below. The reference following each meeting is to the relevant paragraph in the programme.

Nuclear power and reactors

1.	Technical committee on uranium resources (NEA/IAEA)	B. 49
2.	Technical committee on IUREP follow-up	B. 49
3.	Technical committee on research and development in uranium exploration techniques (NEA/IAEA)	B. 50
4.	Advisory group on vein-type and similar uranium deposits	B. 52
5.	Advisory group on uranium exploration techniques	B. 52
6.	Technical committee on natural fission reactors	B. 53
7.	Advisory group on the front end of the fuel cycle	B. 64
8.	Technical committee on fuel performance and technology (IWG)	B. 74
9.	Advisory group on small and medium power reactors	B. 103
10.	Advisory group on electricity system planning	B. 113
11.	Advisory group on manpower development	B. 136
12.	Advisory group on nuclear power project technician training	B. 139
13.	Technical committee on nuclear power plant control and instrumentation (IWG)	B. 177
14.	Technical committee on costing heat from nuclear power plants	B. 187
15.	Technical committee on fast reactors (IWG)	B. 200
16.	Technical committee on high-temperature reactors (IWG)	B. 201
17.	Technical committee on materials for advanced nuclear applications	B. 208
18.	Technical committee on the interpretation of in-core physics measurements	B. 218
19.	Technical committee on reactor radiation measurements (IWG)	B. 218
20.	UNESCO/IAEA International Liaison Group on MHD Electrical Power Generation (Technical committee)	B. 225

Nuclear safety and environmental protection

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|-----|--|--------|
| 21. | Technical committee on criticality alarm systems | C. 25 |
| 22. | Technical committee on the monitoring and control of releases of carbon-14 from nuclear facilities | C. 38 |
| 23. | Advisory group on procedures for establishing limits for releases of radioactive materials to the environment | C. 35 |
| 24. | Advisory group on radiological protection services for fuel reprocessing plants | C. 26 |
| 25. | Advisory group on the Agency's future programme on applied radiological protection | C. 28 |
| 26. | Advisory group on transport package test standards | C. 47 |
| 27. | Advisory group on research and development in nuclear transport technology | C. 47 |
| 28. | Advisory group on physical and medical surveillance for occupationally exposed persons | C. 22 |
| 29. | Advisory group on the application of cost-benefit analysis to radiological protection | C. 23 |
| 30. | Advisory group on radiological safety aspects of nuclear fusion reactors | C. 26 |
| 31. | Advisory group on the revision of the Agency publication "Manual on safety aspects of the design and equipment of hot laboratories" (Safety Series No. 30) | C. 24 |
| 32. | Technical committee on the retention of gaseous radionuclides from nuclear power plants under normal and accident conditions | C. 103 |
| 33. | Technical committee on high-level and alpha-bearing wastes | C. 100 |
| 34. | Technical committee on improvements in the treatment of low- and medium-level liquid wastes | C. 102 |
| 35. | Technical committee on the revision of the Agency publications "Treatment of low- and intermediate-level radioactive waste concentrates" (Technical Reports Series No. 82) and "Bituminization of radioactive wastes" (Technical Reports Series No. 116) | C. 102 |
| 36. | Technical committee on volume reduction techniques for solid radioactive wastes | C. 102 |
| 37. | Technical committee on the storage of high-level liquid wastes | C. 100 |
| 38. | Technical committee on the preparation of spent fuel elements for long-term storage and/or disposal | C. 100 |
| 39. | Technical committee on procedures for the decontamination of operating nuclear power plants and for handling the decontamination wastes | C. 128 |

40.	Technical committee on the behaviour of transuranic and other selected radionuclides in the oceans and seas, including their exchange on marine sediments	C. 117
41.	Advisory group on waste management at uranium refining facilities	C. 101
42.	Advisory group on safety assessments for geological disposal	C. 98
43.	Advisory group on site investigations for the disposal of solid radioactive waste in geological formations	C. 98
44.	Advisory group on site investigations for the disposal of liquid radioactive waste in geological formations	C. 98
45.	Advisory group on the Agency's definition and recommendations for the Protocol on the Protection of the Mediterranean Sea against Pollution from Land-based Sources	C. 116
46.	Advisory group on container specifications for ocean dumping	C. 117
47.	Advisory group on the decommissioning of nuclear reactors	C. 128
48.	Advisory group on the Agency's environmental assessment programme	C. 118
49-66.	18 Technical Review Committee meetings	C. 140
67-70.	4 Senior Advisory Group meetings	C. 140
71.	Advisory group on reactor safety research and development	C. 158
<u>Nuclear explosions for peaceful purposes</u>		
72.	Advisory group on health and safety aspects of the use of PNEs	D. 12
<u>Food and agriculture</u>		
73.	Advisory group on nuclear techniques in fertilizer management practices for specific tree crops	E. 24
74.	Advisory group on the use of isotopes in animal parasitology and immunology	E. 94
75.	Advisory group on the in vitro rearing of tsetse fly species as related to the use of the sterile-insect technique	E. 116
76.	Advisory group on the economics and the energy aspects of food irradiation	E. 160
<u>Life sciences</u>		
77.	Advisory group on the maintenance of nuclear medicine equipment in developing countries	F. 21
78.	Advisory group on the quality control of in vivo radionuclide procedures	F. 38

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| 79. | Advisory group on high-energy photon and electron dosimetry | F. 75 |
| 80. | Technical committee on the standardization of biological methods for tritium hazard evaluation | F. 146 |
| 81. | Advisory group on applications of recent radiobiological research results in radiotherapy | F. 128 |
| 82. | Advisory group on the comparison of health impacts of nuclear and non-nuclear energy sources | F. 167 |

Physical sciences

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| 83. | Advisory group on the formulation and management of research programmes involving the use of low- and medium-flux research reactors | G. 28 |
| 84. | Technical committee on sources, effects and control of impurities in nuclear fusion | G. 45 |
| 85. | Technical committee on alternative confinement systems | G. 45 |
| 86. | Technical committee on reactor concepts involving inertial confinement | G. 45 |
| 87. | Technical committee on high-power auxiliary heating | G. 45 |
| 88. | Advisory group on oxygen activity changes in oxide fuels due to burn-up, oxygen redistribution, chemical interactions between fuel and cladding and reactions involving fission products | G. 90 |
| 89. | Advisory group on the use of isotope techniques in investigating new energy sources and in energy-saving | G. 64 |
| 90. | Technical committee on the economics of radioisotope applications in industry | G. 77 |
| 91. | Advisory group on the application of isotope techniques in mining and waste disposal hydrology | G. 124 |
| 92. | International Hydrological Programme's Working Group on Nuclear Techniques (Technical committee) | G. 102 |
| 93. | Advisory group on transactinium isotope nuclear data | G. 153 |

International Centre for Theoretical Physics

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| 94. | Scientific Council | I. 9 |
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Safeguards

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|-----|---|----------|
| 95- | Standing Advisory Group on Safeguards Implementation | |
| 97. | (SAGSI) (probably three sessions) | K. 15 |
| 98. | Advisory group on methods and techniques for safeguards verification measurements of spent nuclear fuel | K. 48(a) |

- | | | |
|------|--|-------|
| 99. | Advisory group on the structure of a world safeguards implementation model | K. 45 |
| 100. | Advisory group on a methodology for safeguards effectiveness evaluation | K. 57 |
| 101. | Advisory group on safeguarding fuel element fabrication plants | K. 42 |
| 102. | Advisory group on evaluation of the quality of safeguards analytical measurement data (PAFEX) | K. 77 |
| 103. | Advisory group on evaluation of the quality of safeguards non-destructive assay measurement data | K. 77 |

Information and technical services

- | | | |
|------|--|-------|
| 104. | Consultative meeting of INIS Liaison Officers (Technical committee) | L. 26 |
| 105. | Advisory Committee for INIS (Technical committee) | L. 25 |
| 106. | Technical committee on further development of the INIS on-line access system | L. 27 |

Executive management and technical programme planning

- | | | |
|------|--|------|
| 107- | Scientific Advisory Committee (two sessions) | N. 4 |
| 108. | | |

ANNEX III

CONFERENCES AND SYMPOSIA IN 1980

A list of scientific meetings considered by the Scientific Advisory Committee is presented for the second year of the biennium 1979-80. The reference following each meeting is to the relevant paragraph in the programme.

Nuclear power and reactors

1. Symposium on safety-related aspects of water reactor fuel performance B. 76
2. Symposium on general design problems of nuclear power plants B. 165
3. Symposium on water chemistry and corrosion problems of nuclear reactor systems and components B. 181

Nuclear safety and environmental protection

4. Symposium on the management of gaseous wastes from nuclear facilities C. 103
5. Symposium on the disposal of radionuclides into the marine environment C. 117
6. Symposium on the siting of nuclear facilities C. 154

Food and agriculture

7. FAO/IAEA symposium on isotope and radiation techniques in soil physics and irrigation studies E. 30
8. FAO/IAEA symposium on combination processes in food irradiation E. 160

Life sciences

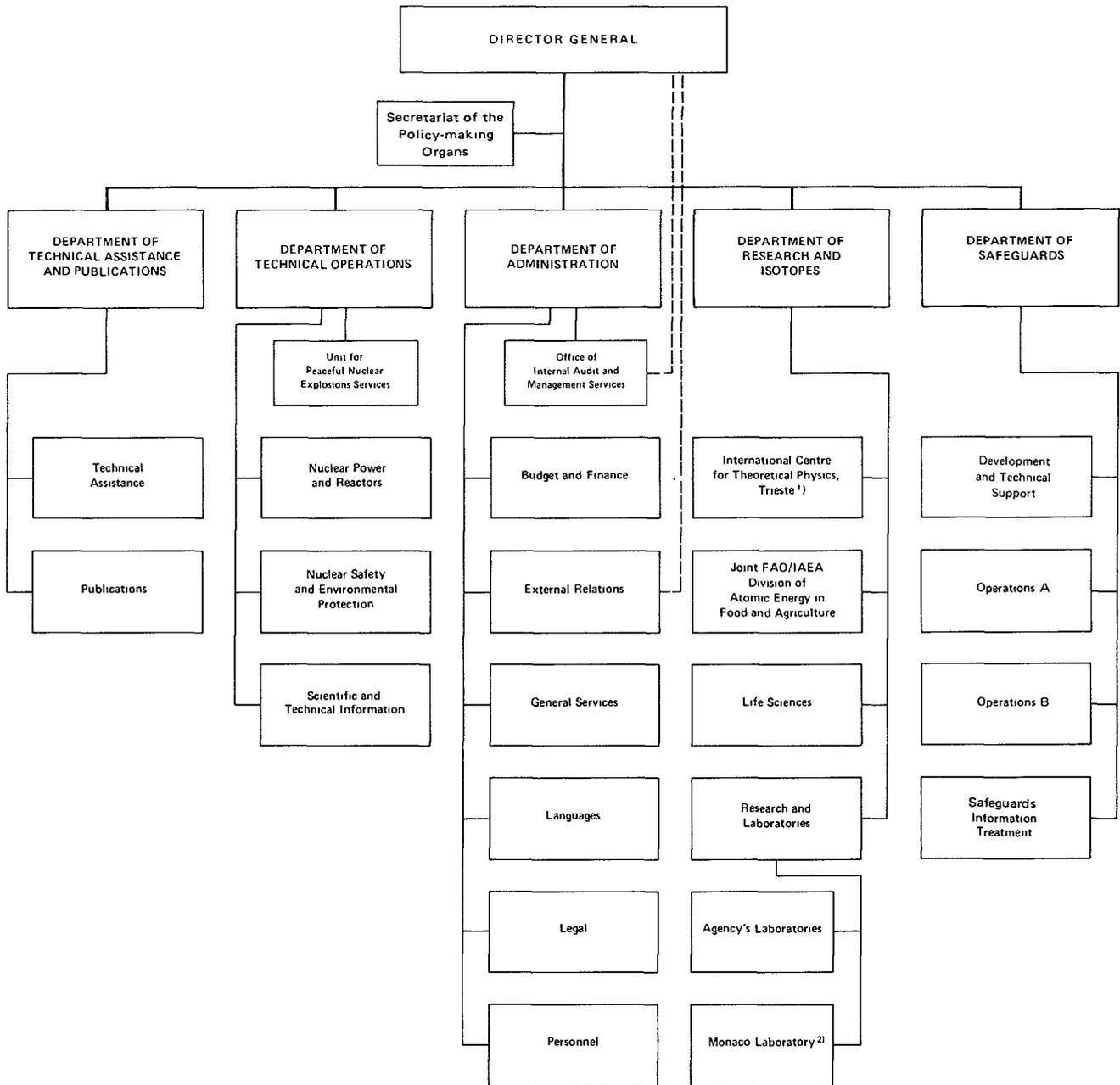
9. Symposium on medical radionuclides imaging F. 39
10. Symposium on comparative health impacts of nuclear and alternative sources of energy F. 167
11. Symposium on biomedical dosimetry: physical aspects, instrumentation, calibration F. 58

Physical sciences

12. Conference on plasma physics and controlled nuclear fusion research G. 45
13. Symposium on isotope geochemistry, geochronology and cosmochemistry G. 134

ANNEX IV

ORGANIZATIONAL CHART



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

ANNEX V

THE MANNING TABLE

Manning Table for 1979

Table 1

	DG	DDG	D	P-5	P-4	P-3	P-2	P-1	Sub-total	GS	M&O	Total
Office of the Director General	1	-	1	1	1	-	1	-	5	4	-	9
Secretariat of the Policy-making Organs	-	-	1	1	-	-	1	-	3	2	-	5
Department of Administration	-	1	-	1	-	-	1	-	3	2	-	5
Office of Internal Audit and Management	-	-	1	-	1	2	1	-	5	4	-	9
Division of Budget and Finance	-	-	1	4	6	4	5	2	22	39	-	61
Division of General Services	-	-	1	2	3	2	1	-	9	71	129	209
Division of External Relations	-	-	2	6	8	7	4	-	27	26	-	53
Division of Languages	-	-	1	4	10	22	-	-	37	37	1	75
Legal Division	-	-	1	3	2	1	1	-	8	5	-	13
Division of Personnel	-	-	1	2	4	3	-	-	10	30	-	40
Department of Research and Isotopes	-	1	-	1	-	-	1	-	3	2	-	5
Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture	-	-	-	7	6	1	1	-	15	8	-	23
Division of Life Sciences	-	-	1	5	7	1	1	-	15	10	-	25
Division of Research and Laboratories	-	-	1	6	10	6	3	-	26	17	-	43
The Agency's Laboratory	-	-	-	4	13	7	3	2	29	60	24	113
The Monaco Laboratory	-	-	-	3	2	1	-	2	8	15	-	23
International Centre for Theoretical Physics	-	-	-	1	2	2	-	-	5	17	-	22
Department of Safeguards	-	1	-	4	7	2	-	-	14	13	-	27
Division of Development and Technical Support	-	-	1	10	14	2	-	-	27	14	-	41
Divisions of Operations	-	-	2	21	56	45	-	-	124	40	-	164
Division of Safeguards Information Treatment	-	-	1	6	10	3	-	-	20	31	-	51
Department of Technical Assistance and Publications	-	1	-	1	2	2	-	-	6	7	-	13
Division of Technical Assistance	-	-	1	7	9	7	3	-	27	35	-	62
Division of Publications	-	-	1	1	1	4	8	-	15	108	14	137
Department of Technical Operations	-	1	-	-	-	1	-	1	3	2	-	5
Unit for Peaceful Nuclear Explosions Services	-	-	-	1	-	-	-	-	1	1	-	2
Division of Nuclear Safety and Environmental Protection	-	-	1	16	16	3	-	-	36	25	-	61
Division of Nuclear Power and Reactors	-	-	1	11 ^{a/}	14	4	2	-	32	16	-	48
Division of Scientific and Technical Information	-	-	1	4	11	12	2	4	34	77	-	111
TOTAL	1	5	21	133	215	144	39	11	569	718	168	1 455

a/ One staff member has the rank of "Principal Officer".

SUMMARY OF MANPOWER BY GRADE OF POST
AND BY DEPARTMENT

Table 1. a

	Number of established posts					
	1977 Adjusted	1978	1978 Adjusted	Change	1979	1980 Preliminary estimate
Grade of post						
DG	1	1	1	-	1	1
DDG	5	5	5	-	5	5
D	21	21	21	-	21	22
P-5	116	121	121	12	133	139
P-4	165	189	189	26	215	244
P-3	116	125	125	19	144	155
P-2	43	42	42	(3)	39	42
P-1	14	12	12	(1)	11	11
Sub-total	481	516	516	53	569	619
GS	648	690	690	28	718	788
M&O	168	168	168	-	168	171
TOTAL	1297	1374	1374	81	1 455	1 578
Department						
				P	GS	
Office of the Director General	12	14	14	-	-	14
Department of Administration	452	463	463	2	-	465
Department of Research and Isotopes	253	254	254	-	-	254
Department of Safeguards	161	213	213	44	26	283
Department of Technical Assistance and Publications	196	205	205	5	2	212
Department of Technical Operations	223	225	225	2	-	227
TOTAL	1297	1374	1374	53	28	1 455

New posts for 1979

Table 2

	DG	DDG	D	P-5	P-4	P-3	P-2	P-1	Sub- total	GS	M&O	Total
Department of Administration	-	-	-	-	-	-	-	-	-	-	-	-
Division of Budget and Finance	-	-	-	-	2	-	-	-	2	-	-	2
Department of Safeguards	-	-	-	1	3	-	-	-	4	3	-	7
Division of Development and Technical Support	-	-	-	2	-	1	-	-	3	2	-	5
Divisions of Operations	-	-	-	7	18	9	-	-	34	13	-	47
Division of Safeguards Information Treatment	-	-	-	1	2	-	-	-	3	8	-	11
Department of Technical Assistance and Publications	-	-	-	-	-	1	-	-	1	-	-	1
Division of Technical Assistance	-	-	-	-	-	3	-	-	3	3	-	6
Department of Technical Operations	-	-	-	-	-	-	-	-	-	-	-	-
Unit for Peaceful Nuclear Explosions Services	-	-	-	-	(1)	-	-	-	(1)	-	-	(1)
Division of Nuclear Safety and Environmental Protection	-	-	-	-	2	-	-	-	2	-	-	2
Division of Scientific and Technical Information	-	-	-	-	1	-	-	-	1	-	-	1
TOTAL	-	-	-	11	27	14	-	-	52	29	-	81

ADDITIONAL PROFESSIONAL POSTS IN 1979

Division of Budget and Finance

Because of an increased work load (due partly to the initiation of additional new activities) and the introduction of further necessary improvements, the present complement of only two Professional staff members in the Programme and Budget Section is inadequate for preparing the programme budget, administering the budget and the financial plan and performing other essential tasks. Despite the temporary assignment of a P-4 staff member to the Section and an inordinate amount of voluntary overtime work during the preparation of the present budget, it was not possible to meet scheduled completion dates in the budget preparation cycle. The capability to administer effectively the budget and the financial plan throughout the year does not exist. The further necessary improvements include the earlier preparation of monthly budget status reports for management use, the design and implementation of a monthly income reporting system, better structuring of accounts and improved reporting in respect of extrabudgetary resources (for control purposes) and the establishment of a capability for investigating, analysing and reporting on high priority or "in trouble" activities the status of which should be brought to the management's attention in good time. (1 P-4)

The need to initiate and strengthen several activities in the area of the establishment of policy and procedures, which is outside the main stream of the Division's day-to-day production work, calls for an additional P-4 post. Specific tasks requiring attention or increased effort include: the further improvement of the computerized accounting and budgetary system (with particular regard to the payroll system and to technical assistance); the preparation, issuing and maintenance of a manual of accounting and budget procedures which amplifies the present interim financial instructions; an in-depth examination of and improvement in cost measurement and allocation activities (with particular regard to common service activities at the Permanent Headquarters); and an in-depth examination of the Agency's Financial Regulations and Interim Financial Rules. (1 P-4)

Department of Safeguards

Three Professional posts are required for the Safeguards Evaluation Section. Two Professional officers (at the P-4 level) are needed for the continuing assessment of the effectiveness of safeguards activities and one (at the P-5 level) for the preparation of Safeguards Implementation Reports. (1 P-5)
(2 P-4)

In the Section for Standardization and Administrative Support, preparation of the documentation for the Standing Advisory Group on Safeguards Implementation (SAGSI) and participation in the preparation of subsidiary arrangements to ensure consistency in technical and administrative procedures call for one additional Professional post (at the P-4 level). At present, the work in question is being done by a cost-free expert, but as of 1979 an additional staff member will be required. (1 P-4)

Division of Development and Technical Support

The work load of the Systems Studies Section will increase significantly in 1979 due to the assignment of tasks connected with analysis and evaluation of the effectiveness of applied safeguards concepts and the development of alternative safeguards approaches and procedures in support of the Safeguards Evaluation Section. For these tasks one additional P-5 post is required. (1 P-5)

In 1979 a computerized data base forecasting system will be in full operation. For the effective collection and treatment of data on the facilities and nuclear material to be placed under safeguards, an additional P-3 post is required (the work involved is at present being done by a cost-free expert who will not be available in 1979); (1 P-3)

It is expected that the work load of the Section for Development of Instruments, Methods and Techniques will grow substantially late in 1978 as advanced measurement technology for improving inventory verification by the non-destructive assay of additional, important forms of nuclear material becomes available for use in the field; the familiarization of safeguards inspectors with this measurement technology will involve the increased participation of members of the Section in inspections. Further, it is expected that the Section's work load will also grow in connection with the implementation of the expanded programmes of technical support for safeguards of a growing number of Member States. An additional P-5 post is required. (1 P-5)

Divisions of Operations

It is expected that, in 1979, additional inspectors will be required for the two Divisions of Operations in connection with the full application of Agency safeguards in the non-nuclear-weapon Member States of EURATOM, the application of safeguards pursuant to the offers made by France, the United Kingdom and the United States, the normal growth in the amount of safeguarded nuclear materials (especially in reprocessing and fuel fabrication plants) and the start-up of new power plants in States where safeguards are already being applied. (7 P-5)
(18 P-4)
(9 P-3)

The above requirement has been arrived at as follows: the inspection effort in man-days per annum has been calculated for each nuclear facility or accountability area subject to safeguards and the total manpower needs estimated so as to allow for travel, discussions with local authorities and time spent at Headquarters in preparing and reporting on inspections, preparing subsidiary arrangements and facility attachments, working out specific safeguards implementation practices and performing country officer duties and other tasks. For the first time, the posting of resident inspectors to certain bulk-handling facilities is foreseen, and this has kept the requirement below what it would otherwise have been.

The proposed increase in the inspectorate will provide sufficient manpower for all facilities subject to safeguards applied in accordance with the present criteria, and it is expected that the number of additional posts proposed for 1980 will be lower than that proposed for 1979, reflecting currently anticipated increases in the number of facilities in countries where safeguards are already being applied.

Division of Safeguards Information Treatment

The functions of Data Base Co-ordinator - which include data base planning, management and updating and the design and administration of a data security system - are at present being performed by a cost-free expert. In 1979, it will be necessary to transfer them to a staff member, for whom an additional P-5 post is required. (1 P-5)

Much of the systems development work of the Section for Data Processing Development is at present being done by cost-free experts. During 1978, some of the long-term development activities will be assumed by staff members, so that one additional P-4 post will be needed in 1979. (1 P-4)

In the field of isotope correlation techniques, one P-4 post is needed for the Data Evaluation Services Section to facilitate safeguards verification at reprocessing, enrichment and other bulk-handling plants. (1 P-4)

Division of Technical Assistance and Programme Co-ordination Section

In addition to an increase in the number of UNDP projects and of regular programme projects to be executed, the Group of Experts convened to advise the Director General on the implementation of the Agency's technical assistance programme recommended an increase in the number of programming missions and various other measures aimed at a quicker rate of delivery of assistance and a better control of operations. To cope with the consequent significant increase in the workload of the Africa Section, one additional P-3 post is required. (1 P-3)

Because of the significantly increasing work load of the Equipment Section (in connection with the procurement of equipment for regular programme projects, for UNDP projects and for SIDA projects), a Procurement Officer with practical experience in the procurement of scientific instruments and other technical devices is required. The additional post would help to ensure the procurement of equipment in accordance with the established schedules of projects being implemented; it would also relieve the senior staff in the Equipment Section of procurement work in connection with individual projects, leaving more time for improving the organization of the Section's activities and co-ordinating them with those of other units within the Agency and of the responsible persons in the recipient countries. (1 P-3)

Besides being responsible for the current training course programme, the chief of the Training Courses Section has since January 1977 been heavily involved in the planning of courses for future years. A second Professional officer is therefore urgently required both to assist the Section chief and to run the Section during his absence - accompanying the participants in study tours and on other duty travel. (1 P-3)

The documents relating to technical assistance which are submitted to the Agency's governing bodies are compiled and/or finalized in the Programme Co-ordination Section. The additional documentation prepared in response to recommendations made by an expert group convened to advise on the implementation of the Agency's technical assistance programme and the introduction of other measures suggested by that group represent a significant increase in the Section's work load. Among its new tasks, the Section is assisting in the preparation of programming missions, the development of management tools for programme monitoring, the utilization of non-convertible currencies and the planning of workshops for technical assistance liaison officers. An additional P-3 post is therefore required to ensure a better distribution of the Section's work load. (1 P-3)

Division of Nuclear Safety and Environmental Protection

An advisory group has recommended that the Agency - in recognition of the rapidly growing traffic in highly radioactive spent nuclear fuel, radioactive wastes and fissile materials - considerably expand its assistance to Member States in the adaptation and implementation of the Agency's transport regulations. This would involve the co-ordination of research programmes, the development and testing of heavily shielded transport casks, the formulation of programmes for quality and compliance assurance, risk assessment and public reassurance, the development of emergency response procedures and the establishment (in collaboration with other organizations) of any additional regulatory requirements considered necessary in the light of experience. (1 P-4)

The advisory group recommended the recruitment of two or three suitably qualified and experienced specialists to perform these tasks on a full-time basis. One additional P-4 post is required for the Radiological Safety Section.

The Agency will continue to respond to requests from Member States for safety missions to advise and assist regulatory bodies in connection with the safety aspects of nuclear power plants. This activity will be directed mainly towards developing countries, who will be assisted in the consideration of safety questions when evaluating bids for nuclear power plants, in the selection of sites, in the review and assessment of preliminary and final safety advisory reports, and in the consideration of safety questions involved in the operation of nuclear plants. The scope of this activity will increase as safety problems requiring attention arise in connection with both new and existing nuclear plants. To meet the increasing demand for nuclear safety missions and to help supply the nuclear safety expertise requested by the Division of Technical Assistance, one P-4 staff member is required for the Nuclear Safety Section. (1 P-4)

Division of Scientific and Technical Information

It has been established that by 1979 a further doubling of computing capacity will be needed to handle the increase foreseen in safeguards data processing requirements. In this connection, one Professional staff member (1 P-4) will be needed in the Systems Programming Group for general systems work requiring a high degree of systems programming skill and experience. (1 P-4)

Sub-total	53
Less: Abolishment of one existing post (at the P-4 level) in the Unit of Peaceful Nuclear Explosion Services	(1)
TOTAL	52

ADDITIONAL GS POSTS IN 1979

Department of Safeguards

Office of the Deputy Director General

The increase in work load in connection with the centralized administration of inspection travel calls for one additional GS clerk. (1 GS)

Two additional GS staff members are needed in the Safeguards Evaluation Section; one would provide secretarial support and the other would assist with statistical and clerical work. (2 GS)

Division of Development and Technical Support

The Systems Studies Section has become responsible for all training within the Department of Safeguards and training activities have increased significantly, so that one additional GS post is required for this section. (1 GS)

One additional GS post is required in the Technical Services Section for a technician to handle (test, repair, maintain, etc.) photographic and video surveillance equipment and to install safeguards instruments in the field. (1 GS)

Divisions of Operations

Due to the increased work load in the two Divisions of Operations, 13 additional GS staff members will be needed for providing secretarial and clerical assistance, including assistance to resident inspectors in the field. (13 GS)

Division of Safeguards Information Treatment

The Section for Data Processing Development will need a GS programmer/analyst in order to complete the transfer of long-term development work from cost-free experts to Agency staff. Furthermore, one GS secretary or documentalist is needed to prepare, maintain, store and retrieve information system documentation and to maintain a number of computerized documentation files. (2 GS)

The number of accounting reports to be received by the Department of Safeguards from Member States in 1979 will be four to five times the present number. Consequently, an additional six GS clerks will be needed in the Section for Data Processing Operations to check, edit and complete the coding of all accounting reports, inspection reports and other incoming information, run queries and distribute printouts to inspectors. (6 GS)

Division of Technical Assistance

One GS post is needed for an additional secretary to support the four Professional staff members in the Fellowships and Training Section and to assist in dealing with fellowship applications during particularly busy periods. (1 GS)

One GS post is needed in the Experts Section, the work of which is increasing in volume as the demand for experts' services in general grows and in complexity as the need for experts in highly specialized fields increases. (1 GS)

One additional clerk/typist is needed for the Equipment Section to assist the additional Professional staff member provided for in the budget and to take over some of the growing volume of work performed at present by other GS staff in the section. (1 GS)

Total 29

Reclassification of existing posts

Table 3

	DG	DDG	D	P-5	P-4	P-3	P-2	P-1	Sub- total	GS	M&O	Total
Department of Administration	-	-	-	-	-	-	-	-	-	-	-	-
Division of Budget and Finance	-	-	-	1	(1)	-	-	-	-	-	-	-
Department of Research and Isotopes	-	-	-	-	-	-	-	-	-	-	-	-
Division of Research and Laboratories	-	-	-	-	-	-	1	(1)	-	-	-	-
The Agency's Laboratory	-	-	-	-	-	1	(1)	-	-	-	-	-
Department of Safeguards	-	-	-	-	-	-	-	-	-	-	-	-
Divisions of Operations	-	-	-	-	-	3	(3)	-	-	-	-	-
Department of Technical Assistance and Publications	-	-	-	-	-	-	-	-	-	-	-	-
Division of Technical Assistance	-	-	-	-	-	-	1	-	1	(1)	-	-
Department of Technical Operations	-	-	-	-	-	-	-	-	-	-	-	-
Division of Scientific and Technical Information	-	-	-	-	-	1	(1)	-	-	-	-	-
TOTAL	-	-	-	1	(1)	5	(3)	(1)	1	(1)	-	-

RECLASSIFICATION OF PROFESSIONAL POSTS IN 1979

Division of Budget and Finance

One P-4 to P-5 (Senior Cost Accountant)

(1 P-5)

The responsibilities of the Senior Cost Accountant have increased significantly in recent years, mainly due to the cost-sharing arrangements with UNIDO and the United Nations for common services at the Permanent Headquarters, the continued growth of laboratory facilities and the consequential allocation of costs to different programmes, the need to improve and develop accounting procedures for operational facilities such as the Trieste Centre and the maintenance of detailed cost control over printing and publishing activities. The present grading of the post is not in line with the responsibilities of the incumbent.

Division of Research and Laboratories

One P-1 to P-2 (Information Specialist)

(1 P-2)

The steady increase in the number of requests for nuclear data and the continuing growth in the volume and variety of nuclear data files have necessitated a reallocation of functions in the Nuclear Data Section as a result of which the Information Specialist has been assigned greater responsibilities and duties. These include the co-ordination of all incoming requests, the checking of data files from outside data centres, the maintaining of computerized files on various aspects of the work of the International Nuclear Data Committee and assistance in the preparation and publication of special data compilations (for example, half-life data compilations).

The increased responsibilities and duties of the Information Specialist are no longer in line with the classification of the post at the lowest Professional grade level.

One P-2 to P-3 (Radioanalytical Chemist)

(1 P-3)

The organization of the Safeguards Analytical Laboratory (SAL) provides for five groups each headed by a Professional staff member. The post of the officer in charge of radiometric analysis is classified only at the P-2 level, which is not compatible with the responsibilities and duties involved.

Divisions of Operations

Three P-2 to P-3

(3 P-3)

It is proposed to replace three P-2 posts by P-3 posts to allow the Divisions of Operations to recruit appropriately qualified and experienced staff to apply safeguards at more complex nuclear facilities.

Division of Technical Assistance
One G-7 to P-2 (Procurement Officer)

(1 P-2)

Over the years the amount of funds handled by the Equipment Section and the quantity of specialized equipment procured have steadily increased. To cope with the increased work load, a redistribution of functions within the Section has become necessary and, as a result, the clerk in charge of technical documentation has been assigned procurement functions normally performed by a Professional staff member. The additional duties (the preparation of cost estimates and purchase orders, contacting potential suppliers, ensuring that the most favourable procurement terms are obtained for the Agency, the co-ordination of procurement actions, etc.) have considerably increased the incumbent's level of responsibility.

Division of Scientific and Technical Information
One P-2 to P-3 (INIS Subject Specialist)

(1 P-3)

The post in question is the only post of an INIS Subject Specialist which is graded at the P-2 level, despite the fact that the incumbent performs the following tasks: the indexing of Agency publications; control of the indexing and quality of input received from Member States; the provision of information retrieval services; participation in the development of the INIS Thesaurus and the formulation of indexing rules. The incumbent's fields of subject specialization are: chemistry (all aspects); earth sciences (other than meteorology and other atmosphere-related sciences); radionuclide effects and kinetics; plant cultivation and breeding; the production of enriched uranium and heavy water; and the production, separation and enrichment of other isotopes.

Adjusted Manning Table for 1978

Table 4

	DG	DDG	D	P-5	P-4	P-3	P-2	P-1	Sub-total	GS	M&O	Total
Office of the Director General	1	-	1	1	1	-	1	-	5	4	-	9
Secretariat of the Policy-making Organs	-	-	1	1	-	-	1	-	3	2	-	5
Department of Administration	-	1	-	1	-	-	1	-	3	2	-	5
Office of Internal Audit and Management	-	-	1	-	1	2	1	-	5	4	-	9
Division of Budget and Finance	-	-	1	3	5	4	5	2	20	39	-	59
Division of General Services	-	-	1	2	3	2	1	-	9	71	129	209
Division of External Relations	-	-	2	6	8	7	4	-	27	26	-	53
Division of Languages	-	-	1	4	10	22	-	-	37	37	1	75
Legal Division	-	-	1	3	2	1	1	-	8	5	-	13
Division of Personnel	-	-	1	2	4	3	-	-	10	30	-	40
Department of Research and Isotopes	-	1	-	1	-	-	1	-	3	2	-	5
Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture	-	-	-	7	6	1	1	-	15	8	-	23
Division of Life Sciences	-	-	1	5	7	1	1	-	15	10	-	25
Division of Research and Laboratories	-	-	1	6	10	6	2	1	26	17	-	43
The Agency's Laboratory	-	-	-	4	13	6	4	2	29	60	24	113
The Monaco Laboratory	-	-	-	3	2	1	-	2	8	15	-	23
International Centre for Theoretical Physics	-	-	-	1	2	2	-	-	5	17	-	22
Department of Safeguards	-	1	-	3	4	2	-	-	10	10	-	20
Division of Development and Technical Support	-	-	1	8	14	1	-	-	24	12	-	36
Divisions of Operations	-	-	2	14	38	33	3	-	90	27	-	117
Division of Safeguards Information Treatment	-	-	1	5	8	3	-	-	17	23	-	40
Department of Technical Assistance and Publications	-	1	-	1	2	1	-	-	5	7	-	12
Division of Technical Assistance	-	-	1	7	9	4	2	-	23	33	-	56
Division of Publications	-	-	1	1	1	4	8	-	15	108	14	137
Department of Technical Operations	-	1	-	-	-	1	-	1	3	2	-	5
Unit for Peaceful Nuclear Explosions Services	-	-	-	1	1	-	-	-	2	1	-	3
Division of Nuclear Safety and Environmental Protection	-	-	1	16	14	3	-	-	34	25	-	59
Division of Nuclear Power and Reactors	-	-	1	11	14	4	2	-	32	16	-	48
Division of Scientific and Technical Information	-	-	1	4	10	11	3	4	33	77	-	110
TOTAL	1	5	21	121	189	125	42	12	516	690	168	1 374

Changes in 1978

Table 5

	DG	DDG	D	P-5	P-4	P-3	P-2	P-1	Sub- total	GS	M&O	Total
Office of the Director General	-	-	-	-	1	(1)	-	-	-	1	-	1
Secretariat of the Policy- making Organs	-	-	-	1	(2)	-	1	-	-	(1)	-	(1)
Department of Administration	-	-	-	-	-	-	-	-	-	-	-	-
Division of General Services	-	-	-	-	1	(1)	-	-	-	-	-	-
Division of External Relations	-	-	-	-	1	-	-	-	1	-	-	1
Division of Languages	-	-	-	(1)	(1)	2	(1)	-	(1)	-	-	(1)
Division of Personnel	-	-	-	-	(1)	1	-	-	-	-	-	-
Department of Research and Isotopes	-	-	-	-	-	-	-	-	-	-	-	-
The Agency's Laboratory International Centre for Theoretical Physics	-	-	-	-	(1)	1	-	-	-	-	-	-
Theoretical Physics	-	-	-	-	1	(1)	-	-	-	-	-	-
Department of Safeguards	-	-	-	-	-	-	-	-	-	-	-	-
Division of Development and Technical Support	-	-	-	(1)	(1)	-	-	-	(2)	(2)	-	(4)
Divisions of Operations	-	-	-	(1)	1	-	-	-	-	-	-	-
Division of Safeguards Information Treatment	-	-	-	2	-	-	-	-	2	2	-	4
Department of Technical Assistance and Publications	-	-	-	-	-	-	-	-	-	-	-	-
Division of Publications	-	-	-	-	1	(1)	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-	-	-	-	-

Preliminary Manning Table for 1980

Table 6

	DG	DDG	D	P-5	P-4	P-3	P-2	P-1	Sub-total	GS	M&O	Total
Office of the Director General	1	-	1	1	1	-	1	-	5	4	-	9
Secretariat of the Policy-making Organs	-	-	1	1	-	-	1	-	3	2	-	5
Department of Administration	-	1	-	1	-	-	1	-	3	2	-	5
Office of Internal Audit and Management	-	-	1	-	2	2	1	-	6	5	-	11
Division of Budget and Finance	-	-	1	4	8	5	5	2	25	47	-	72
Division of General Services	-	-	1	2	3	3	1	-	10	71	129	210
Division of External Relations	-	-	2	6	8	7	5	-	28	29	-	57
Division of Languages	-	-	1	4	11	23	-	-	39	38	1	78
Legal Division	-	-	1	3	2	1	1	-	8	5	-	13
Division of Personnel	-	-	1	2	5	4	-	-	12	37	-	49
Department of Research and Isotopes	-	1	-	1	-	-	1	-	3	2	-	5
Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture	-	-	-	8	6	1	1	-	16	8	-	24
Division of Life Sciences	-	-	1	5	8	1	1	-	16	11	-	27
Division of Research and Laboratories	-	-	1	6	11	8	3	-	29	19	-	48
The Agency's Laboratory	-	-	-	4	14	7	3	2	30	62	27	119
The Monaco Laboratory	-	-	-	3	3	1	-	2	9	16	-	25
International Centre for Theoretical Physics	-	-	-	1	2	2	-	-	5	19	-	24
Department of Safeguards	-	1	1	4	9	2	-	-	17	15	-	32
Division of Development and Technical Support	-	-	1	11	16	2	-	-	30	18	-	48
Divisions of Operations	-	-	2	24	62	46	-	-	134	44	-	178
Division of Safeguards Information Treatment	-	-	1	7	12	3	-	-	23	47	-	70
Department of Technical Assistance and Publications	-	1	-	1	2	2	-	-	6	7	-	13
Division of Technical Assistance	-	-	1	7	10	9	3	-	30	39	-	69
Division of Publications	-	-	1	1	1	4	10	-	17	110	14	141
Department of Technical Operations	-	1	-	-	-	1	-	1	3	2	-	5
Unit for Peaceful Nuclear Explosions Services	-	-	-	1	-	-	-	-	1	1	-	2
Division of Nuclear Safety and Environmental Protection	-	-	1	16	20	3	-	-	40	28	-	68
Division of Nuclear Power and Reactors	-	-	1	11	16	4	2	-	34	19	-	53
Division of Scientific and Technical Information	-	-	1	4	12	14	2	4	37	81	-	118
TOTAL	1	5	22	139	244	155	42	11	619	788	171	1 578

ANNEX VI

IAEA/UNEP COLLABORATION - STATUS ON 30 JUNE 1978

Number assigned by UNEP	Title of project	UNEP contribution proposed by the Agency			UNEP allocation received by the Agency		
		1977	1978	1979	1977	1978	1979
0-501-75-03	Evaluation of releases of radio-nuclides into aquatic environments (Nuclear safety and environmental protection)	31 000	-	-	31 000	-	-
0102-74-001	Studies of the radiation doses to the population from the peaceful use of atomic energy, including nuclear industry (Nuclear safety and environmental protection)	29 000	63 000	-	-	-	-
0102-74-002	Studies of the measures to be taken in international co-operation in the long-term management of high-level and alpha-bearing radioactive wastes (Nuclear safety and environmental protection)	47 400	40 000	-	47 400	40 000	-
0-503-76-09	Biochemical studies of selected pollutants: Open ocean measurements and laboratory experiments (Monaco)	68 000	9 000	-	125 675	34 000	-
0-503-75-04	The Mediterranean programme activity: Intercalibration measurements for pilot projects under the co-ordinated pollution monitoring and research programme - Med IV (Monaco)	22 500	26 000	-	94 733	70 400	-
0-700-75-01	Regional Centres for Nuclear Fuel Cycle (Nuclear power and reactors)	8 000	-	-	38 200	-	-
0-503-76-01	Multi-Agency Mediterranean Programme Activity: Pollutants from land-based sources in the Mediterranean - Med X	-	-	-	4 750	-	-
Proposal pending	Multi-Agency Mediterranean Programme (Nuclear safety and environmental protection)	-	-	102 800	-	-	-
PP/1380	Definition and Recommendation for the Barcelona Dumping Protocol (Nuclear safety and environmental protection)	-	37 700	17 200	-	-	-
TOTAL		205 900	175 700	120 000	741 758	144 400	-

ANNEX VII

Draft resolutions

A. REGULAR BUDGET APPROPRIATIONS FOR 1979

The General Conference,

Accepting the recommendations of the Board of Governors relating to the Regular Budget of the Agency for 1979[1],

1. Appropriates an amount of \$65 177 000 for the Regular Budget expenses of the Agency in 1979, as follows:

<u>Section</u>	<u>United States dollars</u>
1. Technical assistance and training	2 651 000
2. Technical operations[2]	12 244 000
3. Research and isotopes[3]	10 238 000
4. Operational facilities[4]	1 406 000
5. Safeguards	15 653 000
6. Policy-making organs	2 030 000
7. Executive management and administration[5]	7 707 000
8. General services	6 827 000
9. Transfer of the Agency to its Permanent Headquarters	2 079 000
10. Reserve funds for the adjustment of programme cost estimates	4 342 000
TOTAL	<u>65 177 000</u>

2. Decides that the foregoing appropriation shall be financed as follows:

- (a) \$3 655 000 from miscellaneous income; and
- (b) \$61 522 000 from contributions by Member States on the basis of the scale of assessment fixed by the General Conference in Resolution GC(XXII)/RES/.....;

3. Decides further that the funds appropriated for Section 10 in paragraph 1 above shall be used only with the prior approval of the Board of Governors; and

4. Authorizes the Director General:

- (a) To incur expenditures additional to those for which provision is made in the Regular Budget for 1979, provided that the relevant emoluments of any staff involved and all other costs are entirely financed from revenues arising out of sales, work performed for Member States or international organizations, research grants, special contributions or other sources extraneous to the Regular and Operational Budgets for 1979; and

- (b) With the prior approval of the Board of Governors, to make transfers between any of the Sections listed in paragraph 1 above.

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- [1] See document GC(XXII)/600, Table 5.
- [2] For the financing of Nuclear power and reactors, Nuclear safety and environmental protection, Information and technical services and Nuclear explosions for peaceful purposes.
- [3] For the financing of Food and agriculture, Life sciences and Physical sciences.
- [4] For the financing of the International Centre for Theoretical Physics (in part) and the International Laboratory of Marine Radioactivity (in part).
- [5] For the financing of Executive management and technical programme planning, Administration and the undistributed balance of Service activities.

B. OPERATIONAL BUDGET ALLOCATIONS FOR 1979

The General Conference,

Accepting the recommendations of the Board of Governors relating to the Agency's operational programme for 1979[1],

1. Decides that for 1979 the target for voluntary contributions to the General Fund shall be \$8.5 million;
2. Notes that funds from other sources, estimated at \$1 685 000, are expected to be available for that programme;
3. Allocates the following sums for the Agency's operational programme for 1979:

	<u>United States dollars</u>
Operating Fund I	1 285 000
Operating Fund II	8 900 000
	<hr/> 10 185 000

4. Urges all Member States to make voluntary contributions to the General Fund for 1979 in accordance with Article XIV.F of the Statute, with paragraph 2 of its Resolution GC(V)/RES/100 as amended by Resolution GC(XV)/RES/286 or with paragraph 3 of the former Resolution, as appropriate;
5. Authorizes the Director General to incur expenditures for the International Laboratory of Marine Radioactivity or for the International Centre for Theoretical Physics in addition to those for which provision is made in the Operational Budget for 1979, provided that the relevant emoluments of any staff involved and all other costs are entirely financed from revenues arising out of work performed for Member States or international organizations, research grants, special contributions or other sources extraneous to the Regular and Operational Budgets for 1979.

[1] See document GC(XXII)/600, Table 6.

C. THE WORKING CAPITAL FUND IN 1979

The General Conference,

Accepting the recommendations of the Board of Governors relating to the Agency's Working Capital Fund in 1979[1],

1. Approves a level of \$2 million for the Agency's Working Capital Fund in 1979;
2. Decides that the Fund shall be financed, administered and used in 1979 in accordance with the relevant provisions of the Agency's Financial Regulations[2];
3. Authorizes the Director General to make advances from the Fund:
 - (a) Not exceeding \$25 000 at any time, to finance temporarily projects or activities of a strictly self-liquidating character which will not necessitate an increase in the Fund in future years; and
 - (b) With the prior approval of the Board of Governors, unless in his opinion the situation requires immediate action before such approval can be obtained, to meet the cost incurred by the Agency in organizing and rendering emergency assistance to Member States in connection with radiation accidents, up to \$50 000 in each case; and
4. Requests the Director General to submit to the Board statements of advances made from the Fund under the authority given in paragraph 3 above.

[1] See document GC(XXII)/600, para. 27.

[2] INFCIRC/8/Rev. 1 and Mod. 1.

