THE ANNUAL REPORT FOR 1995

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INTERNATIONAL ATOMIC ENERGY AGENCY

Note

1. All sums of money are expressed in United States dollars.

2. The designations employed and the presentation of material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

3. The mention of names of specific companies or products (whether or not indicated as registered) does not imply any intention to infringe proprietary rights, nor should it be construed as an endorsement or recommendation on the part of the Agency.

4. The term "non-nuclear-weapon State" is used as in the Final Document of the 1968 Conference of Non-Nuclear-Weapon States (United Nations document A/7277) and in the Treaty on the Non-Proliferation of Nuclear Weapons.

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AFGHANISTAN
ALBANIA
ALGERIA
ARGENTINA
ARMENIA
AUSTRALIA
AUSTRIA
BANGLADESH
BELARUS
BELGIUM
BOLIVIA
BOSNIA AND HERZEGOVINA
BRAZIL
BULGARIA
CAMBODIA
CAMEROON
CANADA
CHILE
CHINA
COLOMBIA
COSTA RICA
COTE D'IVOIRE
CROATIA
CUBA
CYPRUS
CZECH REPUBLIC
DENMARK
DOMINICAN REPUBLIC
ECUADOR
EGYPT
EL SALVADOR
ESTONIA
ETHIOPIA
FINLAND
FRANCE
GABON
GEORGIA
GERMANY
GHANA
GREECE
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IRAN, ISLAMIC REPUBLIC OF
IRAQ
IRELAND
ISRAEL
ITALY
JAMAICA
JAPAN
JORDAN
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KENYA
KOREA, REPUBLIC OF
KUWAIT
LEBANON
LIBERIA
LIBYAN ARAB JAMAHIRIYA
LIECHTENSTEIN
LITHUANIA
LUXEMBOURG
MADAGASCAR
MALAYSIA
MALI
MARSHALL ISLANDS
MAURITIUS
MEXICO
MONACO
MONGOLIA
MOROCCO
MYANMAR
NAMIBIA
NETHERLANDS
NEW ZEALAND
NICARAGUA
NIGER
NIGERIA
NORWAY
PAKISTAN
PANAMA
PARAGUAY
PERU
PHILIPPINES
POLAND
PORTUGAL
QATAR
ROMANIA
RUSSIAN FEDERATION
SAUDI ARABIA
SENEGAL
SIERRA LEONE
SINGAPORE
SLOVAKIA
SLOVENIA
SOUTH AFRICA
SPAIN
SRI LANKA
SUDAN
SWEDEN
SWITZERLAND
SYRIAN ARAB REPUBLIC
THAILAND
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA
TUNISIA
TURKEY
UGANDA
UKRAINE
UNITED ARAB EMIRATES
UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND
UNITED REPUBLIC OF TANZANIA
UNITED STATES OF AMERICA
URUGUAY
UZBEKISTAN
VENEZUELA
VIET NAM
YEMEN
YUGOSLAVIA
ZAIRE
ZAMBIA
ZIMBABWE

The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

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CONTENTS

PREFACE

The past year saw a process of strengthening in some important areas of the work of the Agency with the aim of improving the impact and efficiency of its activities.

Strengthening of Safeguards

The Agency's efforts to develop a strengthened safeguards system have been incorporated into its Programme "93 + 2", building on three essential elements: increased access to information about a State's nuclear activities; broader access to sites and locations within a State; and expanded use of new and available technologies to increase detection capacity and, in due course, to reduce the frequency of on-site inspections. The first of two interrelated sets of strengthening measures was accepted by the Board of Governors in June (*see Box 1*).

Democratic People's Republic of Korea

At the end of 1995, the Democratic People's Republic of Korea (DPRK) was still not in full compliance with its safeguards agreement pursuant to the NPT. At the request of the United Nations Security Council, Agency inspectors have been present in the Nyongbyon area since May 1994 and since November of that year the Agency has (with the authorization of the Board of Governors) monitored a "freeze" on the DPRK's graphite moderated reactors and related facilities as provided for in the "Agreed Framework" between the USA and the DPRK of 21 October 1994. The DPRK has enabled the Agency to implement certain safeguards measures and activities but did not accept other activities, such as the monitoring of the nuclear liquid waste at the reprocessing plant (Radiochemical Laboratory) and measurement of the plutonium content of the spent fuel at the 5 MW(e) reactor. In addition to the safeguards activities carried out at facilities subject to the "freeze", the Agency continued to conduct inspections at DPRK facilities not covered by the "freeze". Agreement was reached with the DPRK in September to enable Agency inspectors to photograph the new process line and other areas of the DPRK's reprocessing plant known as the Radiochemical Laboratory. By the end of the year, however, inspectors had not been allowed to carry out these activities as DPRK operators raised new objections and imposed unacceptable preconditions.

Iraq

The Agency's safeguards obligations in Iraq continued under the mandate assigned to the Agency by resolutions of the United Nations Security Council. Since August 1994, the Agency has maintained a continuous presence in Iraq in order to carry out monitoring and verification inspections to confirm Iraq's compliance with the relevant Security Council resolutions.

Box 1
STRENGTHENING THE SAFEGUARDS SYSTEM

In 1995 the Board of Governors accepted the Director General's plan to implement at an early date under existing legal authority measures aimed at strengthening the present safeguards system. These measures include:

Broader access to information
- through the provision by States of: an expanded declaration on the State or regional system of accounting and control of nuclear material (SSAC); information on present nuclear activities; and information on planned nuclear activities;
- through the taking of environmental samples; and
- through the improved analysis of information.

Greater physical access
- through greater use of unannounced routine inspections.

Optimization of the present system
- through the introduction of new safeguards measurement and surveillance systems; and
- through increased co-operation with States and SSACs.

In December 1995, the Board of Governors held an initial review of the Secretariat's discussion paper on measures which would require additional legal authority to implement. The discussion paper represents another step in the consultative process designed to foster consensus on the required strengthening measures.

In August, the Agency received additional information on Iraq's former nuclear weapons programme, transmitted by Iraq to the Agency and the United Nations Special Commission following the departure to Jordan of Lieutenant General Hussein Kamel, the former Iraqi Minister of Industry and Military Industrialization. According to this information, a crash programme to produce a nuclear weapon using high enriched uranium (HEU) contained in the safeguarded research reactor fuel stored at the Iraqi nuclear research centre in Tuwaitha had been launched shortly after Iraq's invasion of Kuwait. On 17 January 1991, the programme was effectively brought to a halt by air raids on Tuwaitha which destroyed the building where the uranium extraction was planned before any processing of the fuel could occur. By this time, however, the equipment needed to extract the uranium had been manufactured and installed in a hot cell facility at Tuwaitha. The additional information is being examined for any new indications which might affect the Agency's assessment that Iraq's practical capability to manufacture nuclear weapons had been destroyed, removed or rendered harmless.

The Agency conducted two ad hoc inspections in 1995 to follow up on the new information received and to further clarify the progress made by Iraq in achieving a nuclear weapons capability in the period immediately preceding the outbreak of the Gulf War.

Treaty on the Non-Proliferation of Nuclear Weapons

In May 1995, the Review and Extension Conference of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) reached the decision to extend the Treaty indefinitely. This decision, and the adoption of the agreed principles and objectives and the strengthened review process, imply a renewed and collective commitment by the Parties to the Treaty to the exclusively peaceful use of nuclear energy and the renunciation of nuclear weapons — a commitment by non-nuclear-weapon States not to acquire such weapons and a commitment by the weapon States to nuclear disarmament.

The outcome of the NPT Conference has far reaching implications for the future work of the Agency. Its role as a central point for international co-operation in the peaceful uses of nuclear energy was confirmed and the Agency was expressly recognized as the competent authority responsible for verifying compliance with safeguards agreements. The Conference called on parties to the NPT who had concerns regarding non-compliance with safeguards agreements to direct such concerns, along with supporting information, to the Agency so that it could investigate, draw conclusions and decide on necessary actions in accordance with its mandate. The Conference further urged support for Agency efforts to strengthen safeguards and to develop its capability to detect possible undeclared nuclear activities.

Backing was given to the concept of an expanded Agency role in verification and it was recommended that nuclear material released from military use be placed under Agency safeguards as soon as practicable and that safeguards be universally applied once the elimination of nuclear weapons has been completed. There was a call for the early conclusion of an agreement to end the production of material for nuclear weapons or other nuclear explosive devices, and for the creation of additional nuclear-weapon-free zones.

The Nuclear-Weapon-Free Zone Treaty in Africa

As requested in 1994 by the General Conference, the Secretariat continued to assist the African States in their effort to establish a nuclear-weapon-free zone and, in particular, to help develop its verification regime. A proposed text, which entrusted the Agency with the task of verification, was adopted by the African Heads of State in Addis Ababa in June. Welcoming the adoption of the text (the "Pelindaba Treaty"), the United Nations General Assembly called upon African States in December to sign and ratify the Treaty as soon as possible.

A Nuclear-Weapon-Free Zone for the Middle East

The General Conference in 1995 requested all parties directly concerned in the Middle East to consider taking steps to establish a mutually and effectively verifiable nuclear-weapon-free zone in the region. The Director General continued consultations with the States of the Middle East to facilitate the early application of full scope Agency safeguards to all nuclear activities in the region and the preparation of model verification agreements.

Nuclear Testing

The General Conference in 1995 adopted a resolution expressing grave concern at the resumption and the continuation of nuclear testing and calling upon those States which have active nuclear testing programmes in place to desist from testing until a Comprehensive Nuclear Test Ban Treaty enters into force. The resolution also called for co-operation between the States concerned and the Agency. Reservations were expressed by some Member States on this resolution. The Government of France requested the Agency to perform a study to assess the full radiological situation in the atolls of Mururoa and Fangataufa, taking into account all past events of

radiological significance. Such a study — which would be funded by extrabudgetary contributions from France — would consist of two parts: an assessment of the current radiological situation; and an evaluation of the potential long term radiological impact. After consultations with Member States and the French authorities, the Director General informed France that the Agency agreed to conduct the study after the cessation of testing.

Radiological Situation in the Marshall Islands

The Agency organized a re-examination of the radiological situation at the Bikini Atoll in the Marshall Islands (*see Box 2*). It also undertook a review of an area in Kazakhstan where nuclear weapons had been tested for many years: comprehensive studies were made on potential doses to the population and on levels of plutonium contamination in the vicinity of the former test site. The results confirm overall that there is no need for concern among those living in the settlements around the test site.

Box 2

REASSESSMENT OF A FORMER NUCLEAR WEAPON TEST SITE

As a consequence of the nuclear weapons tests in the 1940s and 1950s, the inhabitants of the Bikini atoll (now part of the Republic of the Marshall Islands) were evacuated. In the early 1970s, US scientists advised the Bikinians that they could return to the atoll without risk. A few years later, however, the islanders had to be removed from Bikini again. The intake of radioactive substances via the main diet — coconut — had been underestimated.

Since then, several in-depth studies of the radiological situation on and around the former test sites have been made. The US Government sponsored long term studies, and the Marshall Islands themselves financed a completely independent survey. Both undertakings showed that the affected islands would, by now, be safe to live on, providing the islanders did not rely exclusively on local food.

But some scepticism remained and the Marshall Islands, after becoming a Member State of the Agency in 1994, asked for international assistance in reviewing the situation. After considerable preparatory work, an Advisory Group, set up by the Agency and involving experts from Australia, France, Japan, New Zealand, the Russian Federation, the United Kingdom, the USA and WHO, together with a delegation from the people of Bikini, met in Vienna in December.

The panel concluded that the available data on the radiological situation on the Bikini atoll were correct — the different studies, carried out independently of each other, had come to essentially the same results. To further assure the Bikinians, it was agreed that there will be additional radioactive contamination tests of various local foods, carried out at the Agency's laboratories at Seibersdorf.

The Advisory Group concluded that the safe return to Bikini would require measures to reduce the existing radioactivity in local crops to meet the strict international safety standards. It was the unanimous opinion of the experts that caesium remained the only risk factor to the Bikinians. International standards in this regard could be readily achieved by two main strategies: the removal and replacement of contaminated soil; or the effective chemical decontamination of the nutrients taken up by the plants by fertilizing the soil with potassium which would be absorbed by the plant roots and effectively block the residual radioactive caesium.

The decision about a return to Bikini will ultimately have to be made by the Marshall Islanders themselves. However, it is clear that remedial measures are available and that after remedial treatment the atoll could be re-occupied without restriction.

Illicit Trafficking in Nuclear Materials

For the last two years the international community has been concerned about the large number of incidents of illicit trafficking in nuclear materials as well as other radioactive sources. In 1995, the Agency established a special programme in this area and set up a database of trafficking incidents to provide factual information to Member State governments and the public. Since effective national accounting and physical protection are basic prerequisites for preventing nuclear material from falling into unauthorized hands, the Agency conducted training courses in the implementation of State systems of accounting and control of nuclear material and in physical protection methods and technology. With the assistance of donor countries, the Agency co-ordinated technical support for the upgrading of physical protection of nuclear material in the newly independent States of the former Soviet Union. In July, the United Nations Security Council expressed its full support to the Agency and other international bodies for their work in this field.

The 'Red Book'

The new edition of the joint IAEA–OECD/NEA 'Red Book' (*Uranium 1995 — Resources, Production and Demand*), which has long served as a reference text, became a genuinely global report as a result of the inclusion of a large volume of new data from countries from

which information had previously not been available. In addition, 1995 saw the completion and publication (in co-operation with the Geological Survey of Canada) of a new map of the world's uranium deposits.

Plutonium Inventory

Worldwide estimates of civil separated plutonium were developed by the Secretariat and published in the *IAEA Yearbook 1995*. These estimates should serve as a foundation on which appropriate plutonium management concepts can be developed.

Nuclear Liability Convention

The question of nuclear liability continued to be of concern to Member States. At the thirteenth session of the Standing Committee on Liability for Nuclear Damage, broad agreement was achieved on the revision of the Vienna Convention. The Committee adopted, albeit with certain exceptions and reservations, a full set of texts for amendments to the Convention. On supplementary funding, the discussions were based on the new text of a free standing draft convention. While work continued on the strengthening of an international nuclear liability regime, the numbers of States that have adhered to the Vienna Convention and Joint Protocol increased, especially in terms of States in eastern and central Europe, and at the end of the year stood at 26 and 20 respectively (increases of 2 and 4 over 1994).

Convention on Waste Safety

The preamble of the Convention on Nuclear Safety adopted in 1994 urges the preparation of a convention on the safe management of radioactive waste. The Board of Governors convened an open-ended group of legal and technical experts who entrusted its chairman with the preparation of a draft of the convention. The group held a second meeting in December, making good progress.

Co-operation in Nuclear Waste Management in the Russian Federation

In the context of measures to resolve international waste management issues, the Agency, at the request of the Nordic Council of Ministers and with the co-operation of the Russian Federation, organized in May a seminar on international co-operation on nuclear waste management in the Russian Federation. A Contact Expert Group was established under the auspices of the Agency for the purpose of organizing and following up co-operative activities between the Russian Federation and other States and the group held its first meeting in Stockholm.

Nuclear Safety in Eastern Europe and the Former USSR

Agency work on the assessment of the safety of nuclear power plants in eastern Europe and countries of the former USSR made steady progress throughout the year. Since an international consensus has been reached on the major safety issues and their significance for each of the various reactor types, the emphasis shifted to a review of the status of the implementation of the proposed improvements. The results of this work provided critical input into bilateral and multilateral assistance projects co-ordinated by the G-24 mechanisms.

Following the decision by the Armenian Government to restart the Medzamor Unit 2 reactor, an Agency mission visited the plant in April 1995. Its report pointed to a difficult safety situation, including a number of unresolved technical issues. The Director General conveyed the results to the Armenian Government, stressing the importance of solving the safety issues before the plant was restarted and reiterating the need for highly competent and well trained operating staff to be available.

Sealed Radiation Sources

A contribution to the safety of radiation sources worldwide was made by the release during the year of the Sealed Radiation Sources Registry package, consisting of a program diskette and documentation for use by register administrators in Member States. This formed one of the major components in the Agency programme to help improve the control of in-use and spent radiation sources.

Sustainable Development and Nuclear Energy

One of the major challenges in the energy field is to ensure sustainability — a goal that requires improved management of natural resources and a reduction of the emissions which are dangerous to health and the environment. The threat of global climate change due to such emissions is a matter of concern to many governments. However, the first conference on the Framework Convention on Climate Change, held in Berlin at the end of March, showed that reaching an international consensus will take time. Three years after the Rio "Earth Summit" the progress made, for example, in reducing greenhouse gas emissions is extremely small. Carbon dioxide emissions have slowed only marginally in industrialized countries, and have increased significantly in most developing countries owing to energy demand growth and the increasing use of fossil fuels, which are the most readily available energy source. In this context,

the Agency continued to co-operate with other international organizations in drawing up methodologies and databases for the comparative assessment of different options for the production of electric power. An international symposium addressed this issue in Vienna in October (*see Box 3*).

Technical Co-operation Programme

At present only a few developing countries use nuclear power. However, most of them are interested in using non-power nuclear techniques that may help their development and in this regard the Agency continued its major task of assisting in the transfer of the relevant technology. Emphasis was placed on those techniques which will contribute to sustainable development, food production and preservation, the harnessing of fresh water resources, the improvement of industrial processes and the promotion of human health.

Box 3

ELECTRICITY, HEALTH AND THE ENVIRONMENT: COMPARATIVE ASSESSMENT IN SUPPORT OF DECISION MAKING

As a follow-up to the Agency's 1991 symposium in Helsinki on *Electricity and the Environment*, an international symposium on *Electricity, Health and the Environment* was organized in Vienna in October by the Agency and nine other international organizations[1]. The main objective was to exchange information and enhance co-operation between interested parties in the field of electricity demand analysis and supply planning, aiming towards implementing sustainable policies in the power sector, taking into account economic, social, health and environmental factors. Topics covered included data acquisition, the development of computer models for the analysis and assessment of different energy systems, the risks associated with emissions of CO_2 and other greenhouse gases, the health effects of chemical releases, the subjective perceptions of risk, and the inclusion of external costs.

The symposium concluded that:

— Much progress has been made since the Helsinki meeting as a result of the fact that more data and better computer tools, including those developed within the DECADES project, have become available. What is needed now is to promote the use of these tools in comparative assessment studies. This is being done through technical co-operation projects.

— Nuclear power can, and already does, play an important role in reducing CO_2 emissions and other pollutants from the electricity sector. Results were presented showing that the health impacts from nuclear power plants are far lower than those from coal fired plants.

— Significant uncertainties still exist in a number of areas, for example the risks associated with CO_2 emissions and the effects of these emissions on the average temperature, and the risks of small releases of chemical substances. However, it was concluded that if greenhouse effects are included in the overall assessment, hydro power and nuclear power are the only currently available large scale energy sources that have relatively low external costs.

— Positive messages about nuclear power are not getting through to decision makers and the public, or at least are not leading to a more supportive climate for nuclear power. It was therefore recommended that efforts be made to present the results from comparative assessment studies in a more transparent manner so they can be used more readily in decision making processes and communicated to the media and the public. It was suggested that the DECADES project could provide a useful framework for achieving greater international consistency in the approaches used for comparative assessment and for reducing uncertainties in the key data needed for such studies.

The proceedings of both the Helsinki and the Vienna symposia are published by the Agency.

[1]The EC, ESCAP, the World Bank, IIASA, OECD/NEA, OPEC, UNEP, UNIDO and WMO.

A potential application of nuclear power that received particular attention in 1995 was related to the growing problem of potable water in many Member States. Considerable progress was made on the evaluation of the technical and economic feasibility of seawater desalination using nuclear energy. The North African regional feasibility study was completed, showing that the use of nuclear power plants for desalination is technically feasible and that the costs are competitive with those of fossil fuelled plants in the region. A similar feasibility study for Saudi Arabia was under way at the end of the year.

Several initiatives were undertaken to strengthen the technical co-operation programme and to make it more effective and more relevant to sustainable development. Many of these initiatives concentrated on improved planning — such as, for example, the preparation of 27 Country

Programme Frameworks, which provide an orientation for the technical co-operation programme and help to maintain the focus on activities which result in a significant benefit. Other initiatives taken in 1995 involved improvements in management, such as the systematic assessment of the status of radiation safety in Member States and the planning of time limited follow-up activities. These and other measures, together with the careful use of overprogramming, combined to produce the highest programme delivery ever.

A Standing Advisory Group on Technical Assistance and Co-operation (SAGTAC) was established and met for the first time in December. The Group will review policy and strategy and make recommendations to the Secretariat on means of improving the effectiveness and efficiency of the technical co-operation programme.

Joint Programme with FAO

A number of new directions were introduced into the Agency's joint programme with the FAO. In particular, increased use was made of modern biotechnology. A symposium in June confirmed that radiation induced mutations followed by appropriate selection procedures had been successful in improving the performance of germplasm throughout the world: significant achievements during the year in Peru, China and Mali were reported. There was a major success in 1995 with the eradication, using the sterile insect technique (SIT), of the medfly pest from Chile through an IAEA/FAO supported project. The benefits to the Chilean economy were estimated at $500 million annually.

Use of Isotope Techniques in Hydrology

An important part of the Agency's programme in research and development is related to the use of isotope techniques in hydrology. At a symposium in March — the ninth in a regular series — the focus was on practical applications of the techniques in the management of groundwater resources. In this area, a model technical co-operation project in Venezuela produced valuable results (*see Box 4*).

'Hidden Hunger'

The Agency embarked on new programmes in the area of human nutrition, where isotope techniques are being developed and used to monitor and control the impact of nutritional intervention programmes for overcoming "hidden hunger", a term coined by WHO and UNICEF to describe the deficiencies of vitamin A, iron and other essential micronutrients that are affecting hundreds of millions of people in developing countries. Major projects were planned in several Member States in collaboration with WHO and a model technical co-operation project was supported in Peru.

Irradiation of Sewage Sludge

A new Agency co-ordinated research programme was initiated in 1995 on the use of irradiated sewage sludge

Box 4

TAPPING GROUNDWATER RESOURCES IN THE CARACAS VALLEY

The city of Caracas relies on treated surface water derived from a number of reservoirs for its water supply. Increased demand as a result of rapid growth in the city's population (now exceeding 5 million inhabitants), the poor condition of the water distribution system and adverse climatic conditions have led to a serious deficit in the drinking water supply. Additionally, water losses from the distribution system have led to a rise in the water level, making it necessary to pump groundwater to prevent flooding of the underground transportation system. Exploitation of the Caracas aquifer has long been considered as the best approach to reducing the water deficit (currently 260 000 m^3 per day) and avoiding engineering problems in the underground transport system and geotechnical problems in the basements of many buildings.

In 1994, the Agency launched a special technical co-operation project to provide key information on the potential and properties of the Caracas aquifer as an additional source of water. During the past year, hydrological, geophysical, chemical and isotopic data were collected to characterize and identify the sources of recharge to the aquifer, to study the dynamics of the groundwater, and to evaluate the vulnerability to pollution of different sectors of this aquifer located in an urban environment. The information indicated the existence of two groundwater subsystems: the shallow part of the aquifer, characterized by groundwater with fast circulation and highly vulnerable to pollution, and the deep part (below 50 m) with older groundwater, better protected from pollution and with good quality water for drinking purposes.

On the basis of the information obtained through this study, the location and design of new wells was proposed. Fifty new wells will be drilled during 1996 and it is expected that they will contribute to reducing the present water restrictions (up to 12 hours a day in some districts), providing more than 112 000 m^3 per day (around 43% of the existing water deficit). These wells, together with other measures to reduce wastage and leakage to groundwater, will improve the availability of water to the population, especially in some outlying areas of the city where water is still distributed by trucks. Monitoring of the quality of the water pumped from the Caracas aquifer will be carried out by a laboratory being upgraded with Agency assistance.

to increase soil fertility and crop yields and help preserve the environment. The aim is to find ways by which solid and liquid wastes from households and industry can be utilized as a source of organic matter and nutrients for increasing crop production. This could reduce the need for chemical fertilizers and the pollution of other sewage treatment processes. The use of gamma and electron beam irradiators to eliminate disease-producing microbial pathogens is a promising technique that may permit the safe utilization of sludges as a biofertilizer.

Twenty-Fifth Anniversary of INIS

In May, the International Nuclear Information System (INIS) celebrated its 25th anniversary. INIS has played a key role in providing access to nuclear information to support activities worldwide. By December, the INIS database included over 1.8 million references to nuclear literature and was growing at the rate of about 7000 records per month.

International Centre for Theoretical Physics

At the end of the year, administrative responsibility for the International Centre for Theoretical Physics in Trieste was handed over to UNESCO. The Agency, which remains one of the partners in the operation of the Centre, will continue to follow the future activities of the Centre and to co-operate with it actively in certain fields.

United Nations Co-ordination

The fiftieth anniversary of the United Nations, which was celebrated in 1995, encouraged wide public scrutiny of the system. For the Agency it is clear that co-ordination and co-operation amongst international organizations remains a major goal. This was an important theme at a meeting of the United Nations Administrative Committee on Co-ordination (ACC), which was chaired by the Secretary-General and hosted by the Agency in February.

The Agency Beyond 2000

At a two day meeting in June, a number of high level officials from Member States met with the Agency's senior management to look beyond the year 2000. There was a common understanding on a number of points: the role of the Agency will continue to evolve; the verification functions will expand; many of the present activities in the areas of nuclear safety and technology transfer will remain essential; and programmes in the field of nuclear waste are expected to grow. Further, it was generally agreed that although the acquisition of nuclear technologies will increasingly become a matter of commercial rather than governmental decisions, the Agency should be ready to provide impartial advice on the advantages and disadvantages of available nuclear and non-nuclear approaches — in both power and non-power applications.

The Agency on the Internet

Greater use was made throughout the Secretariat in 1995 of new technologies, especially in the area of communications. As the Internet became a more common tool for the public, the media and decision makers, steps were taken to ensure that many Agency products were made available on it.

Gender and Geography in Staff Recruitment

In response to resolutions adopted by the General Conference, special efforts were made to increase the professional representation of women and staff from developing countries in the Secretariat. In a situation where the number of staff is static and where some activities require very specialized skills which are available only from a very limited labour market, rapid change is not easy. However, the Secretariat continued to look for ways to improve the situation.

Membership and Budget

During 1995, Bosnia and Herzegovina joined the Agency, bringing the total membership to 123, an increase of more than 40 over the number of "initial members". It is worth recalling that now for more than a quarter of its history the Agency has been operating under zero real growth. In 1995, the regular budget appropriation for Agency programmes was approximately $251 million and total new resources amounting to around $64 million were available for technical co-operation activities. Extrabudgetary funds, apart from those directed to technical co-operation and the ICTP were at a level of about $32 million.

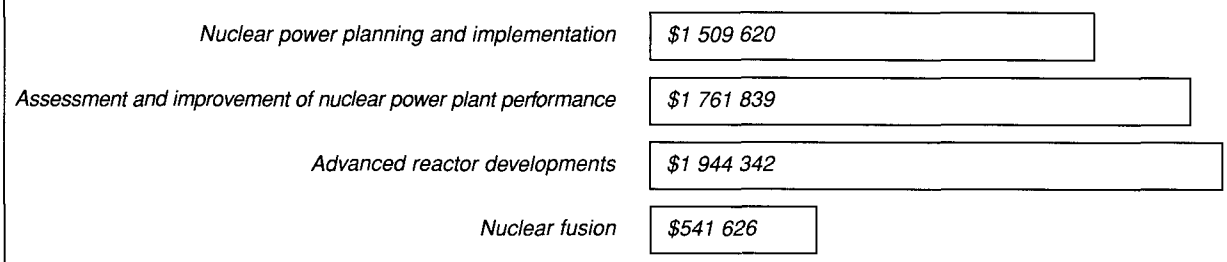
The Agency Remains Dynamic and Solvent

In spite of the constraints on approved resources and continued difficulties caused by some countries failing to make contributions on time, the Agency has managed during the last ten years to deliver an expanding programme and to respond to the needs of Member States. This result certainly could not have been achieved without extrabudgetary contributions from a number of governments. It is also in large measure attributable to the continued search for efficiency and savings as well as to the commitment and professionalism of the Agency's staff and its collaborators around the world.

NUCLEAR POWER

Regular Budget expenditure: $5 757 427

Expenditure by subprogramme



Extrabudgetary programme resources utilized (not included in chart): $235 016

The Agency's activities in 1995 in the area of nuclear power were focused on several areas: developing improved versions of software for energy, electricity and nuclear power planning; assistance in planning studies in developing Member States using the Agency's software; on-line services and systematic monitoring of power reactor information; technology issues on nuclear power plant life management and the human–machine interface; revision of quality assurance standards; technology improvement for advanced nuclear reactors; seawater desalination using nuclear energy; and the transmutation of actinides.

Nuclear Power Planning and Implementation

The need for the Agency to provide assistance in nuclear power programme planning to developing Member States has increased over the years. In 1995, Belarus, Brazil and Poland were added to the list of countries receiving technical co-operation assistance in applying the Energy and Power Evaluation Package (ENPEP), which can be used to assess the nuclear power option. In addition, Albania, Estonia, The Former Yugoslav Republic of Macedonia, Lithuania, Latvia, Moldova and Viet Nam received assistance in defining a framework for technical co-operation projects on energy, electricity and nuclear power planning.

The large number of operating nuclear power plants in Member States makes it imperative that operation and maintenance personnel receive specific training in the reliable and safe operation of these plants. Recognizing this, the Agency in 1995 incorporated a systematic approach to the training of operations and maintenance personnel in a revised version of the Agency's guidebook on nuclear power plant training.

Distribution of computer models

	Number of releases of planning model or package			
	MAED	WASP	VALORAGUA	ENPEP
Member States	43	88	36	39
International organizations	5	12	2	5
Totals	48	100	38	42

ENPEP: Energy and Power Evaluation Package; **MAED:** Model for Analysis of Energy Demand; **VALORAGUA:** 'Valor Agua' (water value); **WASP:** Wien Automatic System Planning Package.

The adoption of an integrated approach to energy, electricity and nuclear power programme planning is assisted greatly by the use of the Agency's Wien Automatic System Planning Package (WASP). The newest version of WASP, known as WASP-III Plus, has been fully documented through the publication of a user's manual in the Agency's Computer Manual Series. In addition, a significantly improved version of WASP, called WASP-IV, was integrated into a single package and is expected to be completed in 1996–1997.

Assessment and Improvement of Nuclear Power Plant Performance

Information for Member States on the status and operating experience of nuclear power plants is provided by the Agency's Power Reactor Information System (PRIS) database. A new version, called PRIS-PC, was made available on-line for direct access through the public telephone network. Internet access will be possible by the end of 1996. A subset of the PRIS database for PC users, MicroPRIS, is now being accessed by 225 users in 54 Member States and 8 international organizations.

An extensive revision was carried out during the year of the complete set of NUSS safety standards and guides on quality assurance. Through the revision of the Code and the associated 14 related Safety Guides, the Agency is seeking to emphasize that managers and workers both contribute to ensuring quality and achieving safety. The Code is thus organized into three functional categories — management, performance and assessment — to underline that quality assurance is everyone's responsibility. This performance based approach to quality assurance serves to correct a common misunderstanding that quality assurance consists only of formalistic requirements of limited practical value.

Computerized support systems for nuclear power plants are already in operation or under development in several Member States. These systems, based on intelligent data processing, are increasingly used for achieving better productivity and improved reliability in nuclear power plants, along with enhanced operational safety. Recognizing the significant progress made by the nuclear industry in developing this technology over the last 25 years, the Agency initiated a CRP in 1992 on operator support systems in nuclear power plants, which was completed in 1995. On the basis of the results obtained, the Agency completed the development of a database that provides consistent and updated reference information on existing operator support systems and related activities in Member States. In the same area, a technical report on the verification and validation of software related to nuclear power plant control and instrumentation was completed. This document contains comprehensive information on computer based systems that play a significant role in the safe operation of nuclear power plants.

An already established database on nuclear power plant life management, which included results from a CRP on the optimization of reactor pressure vessel surveillance programmes and their analysis (Phase III), was expanded and given the title International Reactor Pressure Vessel Database.

Advanced Reactor Developments

Interest in small and medium size reactors (SMRs) for use in non-electrical applications as well as power generation is steadily increasing among Member States. The reactors will most likely find use in such areas as seawater desalination, district heating, oil recovery enhancement, coal gasification and methanol production. The Agency's activities in the field of SMRs focused on providing technical support for these projects. A Technical Committee meeting on small reactors with minimized staffing and/or remote monitoring, held in Mississauga, Canada, in May, assessed the level of interest in small reactors in various countries and explored potential applications and technical approaches of common interest.

An Advisory Group meeting on the introduction of SMRs was held in Rabat, Morocco, in October to review the experience acquired by Member States during the deployment of such reactors. The meeting confirmed that there is a continuing interest in SMR deployment in North African, Middle Eastern and Far Eastern countries, that considerable operating experience has been gained (which can benefit developing countries), but that more information related to the deployment of SMRs is needed. Local participation and technology transfer were recognized as important elements in the introduction of SMRs.

The large capital costs involved in the development of improved and advanced nuclear power plant designs have led to many national and international co-operative efforts. The Agency's role in this context is to serve as a forum for information exchange on national programmes, scientific

and technical issues. In one such international co-operative research activity, the Agency collected and systematized a database of thermophysical properties for a broad spectrum of light and heavy water reactor materials over a wide temperature range. The establishment of such a consistent set of information provides an international source of data for independent examination of the performance and safety of various advanced reactor designs.

A Technical Committee meeting on the design, development and testing of safety systems for advanced water cooled reactors was convened in Piacenza, Italy, in May. The results presented at this meeting indicated that the basic designs of safety systems for large evolutionary plants are well established and have been derived from experience with existing plants.

A Technical Committee meeting on the identification of severe accidents for the design of future nuclear power plants was convened in Vienna as part of the Agency's ongoing activities to establish design safety principles. In addition to agreeing on a consistent set of severe accident phenomena, there was consensus that internal and external events should be addressed and that the resulting design features should provide prevention and mitigation, with priority given to preventive measures.

At the final Research Co-ordination meeting for a CRP on acoustic signal processing for the detection of boiling or sodium water reaction in liquid metal fast reactors (LMFRs), held in Obninsk, the Russian Federation in July, it was reported that the CRP had been able to evaluate different signal processing techniques with real field data. The results were thus invaluable to the designers of acoustic leak detection systems. In the long run, this could help enhance the economics of LMFRs through better surveillance of the reactor core and steam generators. Signal processing techniques developed in this CRP for anomaly detection (i.e. boiling or leaks) can be used to detect other types of anomalies in thermomechanical equipment (such as cavitation and rattling) in fast and thermal reactors.

One of the goals of a CRP on the intercomparison of LMFR seismic analysis codes was to validate and improve the codes used for reactor core seismic analysis through benchmark exercises. At the final Research Co-ordination meeting for this CRP, which was held in Bologna, Italy, these codes were validated on the basis of an intercomparison of experimental and analytical data. It was noted that the results derived from this CRP had a broad range of applicability, since they could be used for different types of reactors.

In 1994, the Agency was requested to initiate the Options Identification Programme (OIP) with the aim of selecting a limited set of practical options for nuclear desalination demonstration facilities. The options were to be based on reactor and desalination technologies which were readily available without any further development. A working group of representatives from interested Member States and the Agency selected the following practical candidates for demonstration projects: a reverse osmosis desalination process coupled to an existing or newly built water cooled reactor of medium-size capacity, and a multi-effect distillation process coupled to a small size reactor in the 20–50 MW(e) range. Either of these options could be implemented in the relatively near future.

A Technical Committee meeting on advanced fuels with reduced actinide generation, held in Vienna in November, identified reactor/fuel combinations, including thermal reactors, fast reactors and accelerator driven systems with fuels or targets from the uranium/plutonium and thorium/uranium families in order to reduce actinide generation. This area of work is of considerable interest for alleviating the problems of plutonium buildup and long lived wastes.

Nuclear Fusion

As part of Agency activities to assist Member States in nuclear fusion research, three Technical Committee meetings were held during 1995. The first meeting, on alpha particles in fusion research, was held at the Princeton Plasma Physics Laboratory, USA, in April. The proceedings were published in the 35th anniversary special issue of the journal *Nuclear Fusion*. The second meeting, on *H* mode physics and also held at the Princeton Plasma Physics Laboratory, reviewed *H* mode transition physics, theory, scaling, edge localized modes, active control, and the potential benefits of *H* mode operations for reactors. The third meeting, on research using small tokamaks, was held in Ahmedabad, India, in December. The topics reviewed included plasma theory, heating, energy confinement, MHD activity and diagnostics in 14 tokamaks.

The final Research Co-ordination meeting for a CRP on the development of software for numerical simulation and data processing in fusion energy was held in Vienna in November. As a result of this CRP, better numerical simulation techniques and computer codes are now available which will help guide future plasma physics research. Many of the newly developed codes are already running in institutes that did not participate in this CRP.

A report on the interim design, cost review and safety analysis for the International Thermonuclear Experimental Reactor (ITER) was produced. This document comes at the mid-point in activities concerned with ITER engineering design. The Agency provided an atomic and molecular physics database to the ITER project and published various administrative and technical documents, including the *ITER Monthly Newsletter.*

NUCLEAR FUEL CYCLE

Regular Budget expenditure: $2 957 904

Expenditure by subprogramme

Raw materials for reactor fuels	*$600 372*
Reactor fuel technology and performance	*$788 155*
Spent fuel management, technology and safety	*$1 154 314*
Information on the nuclear fuel cycle	*$415 063*

Extrabudgetary programme resources utilized (not included in chart): $350 205

Agency activities related to the nuclear fuel cycle concentrate on: the availability and market conditions for uranium resources; fuel technology and performance in reactors; spent fuel management and information systems for fuel cycle facilities; and special nuclear materials. During 1995, comprehensive studies were carried out on the supply and demand for uranium, technology associated with the increased burnup of LWR fuels, safety guidelines for the storage of spent fuel from research reactors, the long term storage of spent fuel, especially under dry conditions and the disposition of plutonium.

Raw Materials for Reactor Fuels

The IAEA–OECD/NEA publication *Uranium 1995 — Resources, Production and Demand* (the 'Red Book'), a standard reference work over the years, has for the first time become a genuinely global report of uranium related activities, with information on 54 countries. The latest edition of this report indicates that while there was no shortage of uranium resources, there was a substantial shortage of production capacity and low cost uranium resources. In 1995, six countries — Australia, Canada, Kazakhstan, Niger, the Russian Federation and Uzbekistan — produced over 70% of the world's total uranium. The 1995 worldwide reactor related requirements were estimated to be about 61 400 tonnes of uranium per year, which was about 29 000 tonnes greater than world uranium production. Thus, only about 53% of the demand was being met by current production. The balance is being filled by inventory drawdown.

Recent changes in the uranium industry were reviewed at a Technical Committee meeting held in Kiev in co-operation with the OECD/NEA. Key issues that were discussed included uranium deposit exploration, exploitation, resources, production and the world supply/ demand relationship. This was the first Agency meeting dealing with these subjects to be held in the Commonwealth of Independent States. Specialists from around the world were able to exchange information at a time of heightened interest in the supply of uranium as a result of predictions of an acute production shortage.

A new map of the world's uranium deposits was published in co-operation with the Geological Survey of Canada. It depicts information on 582 uranium deposits, some of which are active mining operations. The most comprehensive compilation of such data to be published, this map includes previously unavailable information on uranium deposits in eastern Europe, the former USSR and China. A more detailed database on the deposits shown on the map is currently being completed.

Reactor Fuel Technology and Performance

At the second Research Co-ordination meeting of a CRP on stress corrosion cracking of Zircaloy fuel cladding, held in Buenos Aires, data were presented on pre-cracked specimens machined at the host laboratory (AEA Technology, United Kingdom). They were evaluated by the supervisory group (comprising developed countries) and, as a result, the test matrix was modified for the final phase of the CRP. In addition, details of the equipment developed and the procedures to be used in further tests in this CRP were reviewed by the supervisory group, and recommendations for improvements were made.

A Technical Committee meeting on the behaviour of LWR core materials under accident conditions, held in Dimitrovgrad, the Russian Federation, concentrated on the properties of structural and fuel materials and their interaction and behaviour under various accident conditions, including loss of coolant, reactivity insertion and severe accidents. The conclusion was that the available data are not sufficient for high burnup fuel behaviour modelling for either design basis or beyond design basis accidents. However, owing to the complexity and high cost of these experiments, as well as the continuing demand to justify safe high burnup fuel behaviour under accident conditions, international co-operation in this area was viewed as an important complement to national programmes.

Developments in the areas of destructive hot cell examination and fuel rod refabrication techniques were reported by 15 institutes at the final Research Co-ordination meeting of a CRP on examination and documentation methodology for water reactor fuel (ED-WARF-2). This meeting was also held in Dimitrovgrad. As a result of this CRP, a guidebook on destructive examination of water reactor fuel and a catalogue of hot laboratories were completed and will be published in 1996. Together with an earlier published guidebook on the non-destructive examination of water reactor fuel (the result of the ED-WARF-1 CRP), these documents present a complete description of current water reactor fuel post-irradiation examination techniques and their availability worldwide. They will fill a genuine need among fuel designers, vendors and utilities.

Spent Fuel Management, Technology and Safety

An extrabudgetary initiative under the programme on the safety of WWER and RBMK nuclear power plants was initiated in 1995. One of the first activities was the convening of a Technical Committee meeting/workshop on the selection of dry storage technologies. The goal was to provide guidance to experts from eastern European Member States on the methods of selecting interim dry spent fuel storage technologies, and to provide a forum for in-depth discussions on the licensing and safe operation of these facilities. Follow-up activities include the organization of a workshop in 1996 on the licensing and quality assurance of dry storage facilities, as well as new research on the behaviour of spent WWER and RBMK fuel, and the modelling of their physical parameters.

Two international programmes currently dominate activities regarding the management, interim storage and ultimate disposal of spent nuclear fuel from research and test reactors. The first is the Reduced Enrichment for Research and Test Reactors (RERTR) programme, and the second is the proposed take-back of spent research reactor fuel by the country where it was originally enriched. The Agency supported these two efforts in 1995 by co-operating in the convening of the 18th International RERTR Conference in Paris. Other activities focused on obtaining an overview of spent fuel problems at research and test reactors by preparing and maintaining a database. A summary of the database, presented at the 18th RERTR Conference, identified the need for research reactor operators to prepare spent fuel management plans to cover the complete period from reactor core fuel unloading until despatch to a reprocessing facility or to a final repository.

Information on the Nuclear Fuel Cycle

The increasing global inventories of separated civil plutonium are attracting greater international attention and concern. It now appears that plutonium from dismantled nuclear weapons will further increase these inventories. Worldwide estimates of civil separated plutonium were developed and published in the *IAEA Yearbook 1995*. The goal is to produce reliable estimates of present and future inventories of separated civil plutonium, which may then be used to evaluate in an appropriate manner the safety and non-proliferation issues. Such estimates may also provide a foundation on which appropriate plutonium management concepts, including burning and disposal, can be developed.

RADIOACTIVE WASTE MANAGEMENT

Regular Budget expenditure: $7 800 346

Expenditure by subprogramme

Handling, treatment, conditioning and storage of radioactive wastes	*$902 875*
Radioactive waste disposal	*$670 299*
Decontamination and decommissioning of nuclear installations	*$578 640*
Radiological and environmental aspects of waste management	*$842 125 + $2 621 300 (IAEA-MEL): 3 463 425*
Waste management planning and infrastructure	*$2 185 107*

Extrabudgetary programme resources utilized (not included in chart): $952 417 (including IAEA-MEL)

The Agency's 1995 programme on radioactive waste management focused on three major areas: strengthening waste management infrastructures in developing Member States; establishing international principles and standards for the safe management of wastes; and preparing for the convention on waste safety. The increased importance placed by Member States on the decommissioning/dismantling of nuclear installations and the restoration of radioactively contaminated sites was reflected in the introduction of new initiatives in these areas.

Handling, Treatment, Conditioning and Storage of Radioactive Wastes

There are 45 WWER-type reactors in operation around the world and several more are under construction. One of the common features of many of these units is an under-designed waste management system that generates higher amounts of radioactive wastes as compared with other types of reactors. As a consequence, waste management issues were studied in a technical assistance regional project on waste minimization at WWER type reactors that was completed in 1995. Project activities included a review of common problems and the identification of the processes and activities needed to improve existing waste management systems.

Progress was made in developing guidance material on quality assurance and quality control requirements in the production of radioactive waste packages acceptable for the transport, long term storage and disposal of wastes. A report on the characterization of radioactive waste forms and packages was completed. This report provides a comprehensive summary of waste form, container and package properties which are important in obtaining regulatory approval for the use of a waste package for transport, storage and disposal.

The Sealed Radiation Sources (SRS) Registry package, a project within the spent sealed sources programme, was completed. The SRS Registry package consists of a program diskette and documentation on the Registry, installation and operating instructions, and a guide for Registry administrators in Member States. A policy has been formulated governing the distribution of the SRS package, the financial obligations involved and issues related to implementation, such as training and updating.

The Registry is one of the primary components of Agency programmes aimed at improving the control of in-use and spent radiation sources, and will assist countries in their efforts to keep track of all sealed radiation sources from 'cradle to grave'. The first training seminar/ workshop for administrators of the SRS system was held in October 1995 in Vienna. In addition, several countries offered to implement the Registry nationally on a test basis.

Radioactive Waste Disposal

A five year CRP on the performance of engineered barrier materials in near surface disposal was concluded in 1995. The CRP provided an opportunity to share the experience of Member States in the application of engineered barrier materials and to enhance the use of such barriers by improving the techniques and methods used for selecting, planning and testing the performance of various types of materials.

Decontamination and Decommissioning of Nuclear Installations

Decommissioning is a topic of great interest to many countries because of the large number of facilities which have reached or are nearing the end of their operational lifetime. Until recently, attention was focused on the decommissioning of nuclear power and research reactors. Some countries, however, are now devoting greater attention to the decommissioning of non-reactor nuclear facilities, with implementation of these decommissioning programmes being seen as a high priority. As a consequence, the Agency has begun preparation of a technical report, which will be first of its kind dealing specifically with the decommissioning of non-reactor facilities. It will present information on installations already decommissioned and on those for which decommissioning actions are planned or under way.

A number of WWER-440 type nuclear power plants are in operation in seven countries of central and eastern Europe (Armenia, Bulgaria, the Czech Republic, Hungary, the Russian Federation, Slovakia and Ukraine). Five WWER-440 units have been shut down permanently in eastern Germany. In addition to reactors already shut down, a number of reactors will soon reach the end of their foreseen lifetime (25–30 years) and become candidates for decommissioning.

Recognizing the region's need for support in this area, a four year technical co-operation project on planning and managing the decommissioning of WWER type nuclear power plants was initiated in 1995. The project will emphasize WWER-440 reactors, since they have received very little attention in relation to facility decommissioning. An additional complication is that documentation on design, construction and operational aspects, which inevitably have an effect on decommissioning, is scarce and not readily available. The project has been planned in such a way as to include regional workshops and technical visits to several reactor sites, and will assist countries in the development of decommissioning plans for these reactors.

Radioactive contamination of the environment has resulted from several causes: accidents involving radioactive materials; nuclear weapons production and testing activities, activities associated with nuclear power generation; the disposition of by-products from the mining and milling of radioactive ores; past waste management practices (including disposal and releases); and abandoned facilities (e.g. radium factories) where radioactive substances were used. The Agency recently initiated a programme to assist Member States in the remediation and restoration of radioactively contaminated sites. The principal efforts over the next several years will be on: gathering information and data, performing analyses and publishing technical guides, reports and documents on key aspects of environmental restoration; conducting a CRP and an interregional training course on environmental restoration.

Radiological and Environmental Aspects of Waste Management

The Agency will present a report by the end of 1996 to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the London Convention 1972) on the potential impact of the high level radioactive wastes dumped in the shallow waters of the Kara Sea, and on the feasibility of possible remedial measures. During 1995, work on acquiring basic information on waste inventories and making predictions of future releases of radionuclides from the dumped wastes was completed by a working group. The data acquired will be used in 1996 by the environmental modelling and impact assessment working groups as a basis for their calculations.

In support of the final assessment task, experimental and field work was carried out in national institutes and at IAEA-MEL to determine the distribution coefficients between sea water and sediment, and concentration factors for biological species of the Arctic. In relation to

possible remedial actions, a set of options, such as in situ capping or retrieval of certain wastes, followed by transport and storage on land, were selected for closer examination. These options will be examined for their technical feasibility, costs of implementation and radiological impacts, and will be compared with the option of leaving the wastes in the shallow Arctic waters.

A symposium to review recent developments and studies on the environmental impact of radionuclide releases was held Vienna in May. The review included the results of studies aimed at reconstructing radiation doses to exposed individuals due to releases in the early years of the nuclear industry and of projects concerned with the remediation of land contaminated as a result of past releases. The symposium also provided a forum for presenting the main results of an Agency CRP entitled 'Validation of Environmental Model Predictions' (VAMP), and to review progress in the International Arctic Seas Assessment Project (IASAP). The final session of the symposium featured a topical discussion on protection of the environment and the 'precautionary principle' (which calls for precautionary action to be taken to protect the environment from potentially harmful contaminants even if there is no concrete evidence that these contaminants have an adverse effect), a controversial concept which is being debated in many international forums.

Within the framework of the IASAP, IAEA-MEL completed radiochemical analysis of seawater and sediment samples taken during the joint 1994 Norwegian–Russian Federation expedition to the Kara Sea. The results showed that a leakage of several radionuclides had occurred from the waste containers dumped in the Abrosimov and Stepovoy Bays, but that the resulting sediment contamination is limited to the immediate vicinity of the containers. Global and regional modelling of a hypothetical large scale release of radionuclides from the dump sites has shown that only local scale radiological effects may be of importance. The analysis of seawater and sediment samples taken during the 1994 Japan–Republic of Korea–Russian Federation expedition to the far eastern seas did not show any effects from the dump sites.

Other activities related to IASAP included laboratory and field experiments to examine radionuclide accumulation by sediments and biota under Arctic conditions. These studies involved organisms typically found in the Arctic Seas. Measurements were made of their uptake response when exposed to key waste derived radionuclides at low (–2°C) temperatures. It was found that brown macroalgae would be excellent bioindicator organisms for detecting radionuclide contamination in the Kara and Barents Seas.

An intercomparison exercise on biota samples collected on Mururoa Atoll was completed under the Analytical Quality Control Services (AQCS) programme. The radioanalytical performance of the participating laboratories proved to be good, although the activity of the samples analysed was very low.

The field programme carried out by IAEA-MEL on Eutrophic Limits in the Northern Adriatic (ELNA), which employed nuclear techniques to assess carbon flux and burial in the Adriatic Sea, was concluded in mid-1995. The findings were instrumental in establishing the pollution histories of important environmental contaminants, such as PCBs and mercury, in this region of the Adriatic Sea.

Waste Management Planning and Infrastructure

The costs associated with radioactive waste management and the decommissioning of nuclear facilities are of interest to Member States planning nuclear power programmes. To assist them, the Agency convened a meeting of experts in June to prepare a report on this subject. One suggestion was that the Agency should work with other interested international organizations to develop and define a comprehensive list of cost related terminologies. This can potentially facilitate greater communication and more standardized use of terms within the waste management community.

A milestone in the Radioactive Waste Safety Standards (RADWASS) programme was the publication of a Safety Fundamentals document on radioactive waste management and a Safety Standard on establishing a national system for radioactive waste management. These two documents will help to address the need for a set of internationally recognized principles and standards. They are also finding use as source material in the preparatory work for a convention on the safety of radioactive waste management.

At the request of the Norwegian Radiation Protection Authority (NRPA), the Agency assembled a five member team, under its Waste Management Assessment and Technical Review Programme (WATRP), to review Norway's work on establishing a combined storage and

disposal facility for low and intermediate level wastes. The WATRP review team found that the quality, approach and status of the Norwegian programme was satisfactory. The original WATRP review report, which includes a Norwegian translation, was published by the NRPA in December 1995.

Co-operative efforts are continuing to identify effective ways to assist the newly independent states of the former USSR and the Russian Federation with various waste management problems. One activity in this area was a seminar in Vienna on international co-operation on nuclear waste management in the Russian Federation. As a result, a Contact Expert Group (CEG) has been established to try to resolve various radioactive waste management issues. The Agency will act as Secretariat of the CEG, which will include senior representatives from the Russian Federation and co-operating countries. Among other responsibilities, the Agency will maintain a database on high priority Russian waste management needs, and on planned or ongoing co-operative projects.

Among the activities directly assisting developing Member States was a project to create or promote regional technical centres for demonstrating pre-disposal waste management methods and procedures. In 1995, steps were taken to establish two regional centres, one at the Cekmece Nuclear and Training Centre in Istanbul, and the second at the Nuclear Research Centre in Santiago, Chile.

COMPARATIVE ASSESSMENT OF NUCLEAR POWER AND OTHER ENERGY SOURCES

Regular Budget expenditure: $1 964 351

Extrabudgetary programme resources utilized: $121 684

Alleviating and mitigating the impacts of human activities on health and the environment, while continuing to ensure that an adequate supply of electricity is available for social and industrial development, have become global objectives. The Agency's activities in the area of the comparative assessment of nuclear power and other energy sources thus seek to incorporate health and environmental aspects, in addition to technical and economic factors, into policy making for the power sector.

Two studies were conducted jointly by the Russian Federation and the USA, one on alternative strategies for power development — the Joint Electric Power Alternatives Study (JEPAS) — and the second on the options for nuclear power development — the Joint Parallel Nuclear Alternatives Study (JPNAS), both focusing on the Russian Federation. The Agency was asked to evaluate the possibility of using the data and methodologies developed in these studies for similar studies in other countries.

The Agency convened a meeting of experts in November 1995 in Vienna to review the results of these studies. Also reviewed were a number of other cost–benefit studies on electric and nuclear power development, as well as safety studies of older, mainly Soviet designed, reactors that have been carried out by the Agency and different international organizations and national institutes. It was noted at the meeting that the situation in other eastern European countries was significantly different from that in the Russian Federation because most of these countries have only one or two nuclear sites. The studies, however, were considered to be useful as reference material in national or site specific evaluations. A number of possible future areas for study were identified, such as the cost efficiency of safety upgrades for Soviet designed reactors, decommissioning costs, development of a database, spent fuel management costs and technical co-operation support to individual countries.

Important contributions were made by the Agency to the work of the Intergovernmental Panel on Climate Change (IPCC) during 1995, for example a joint IAEA–OECD/NEA publication entitled *Nuclear Power: An Overview in the Context of Alleviating Greenhouse Gas Emissions.* The Agency also participated in the First Conference of the Parties to the Framework Convention on Climate Change, held in Berlin in March, as well as in meetings of various subsidiary bodies established by the Conference of Parties.

The Reference Technology Database was established in 1995. In addition, a new software package, DECPAC, for electricity system analysis was developed and an intensive testing programme was carried out of the methodology and computer tools developed within the DECADES project. A parallel activity was the implementation of country specific databases for 15 countries, covering more than 1500 technologies at all stages of the different energy chains.

Under the DECADES project, an international symposium on electricity, health and the environment was held in October in Vienna. Organized by the Agency and nine other international organizations, the symposium focused on: implementing sustainable electricity policies; the role of international co-operation; assessment of health and environmental impacts; implementation of comparative

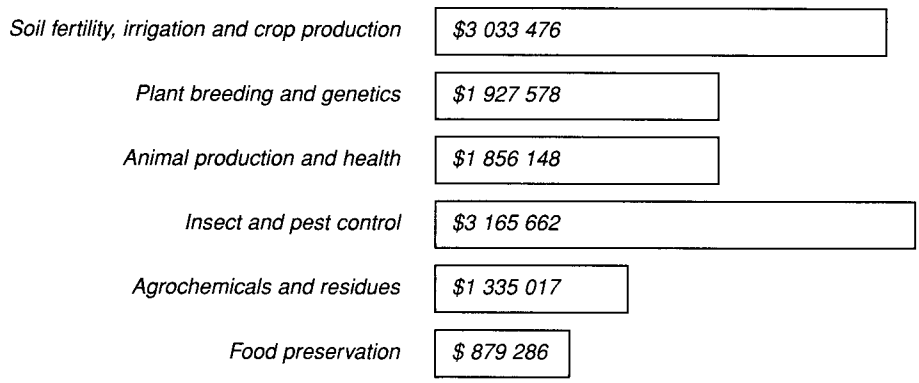
assessment; and national case studies. Many studies and analyses were presented dealing with such subjects as data acquisition and the development of computer models for the analysis and assessment of different energy systems, the risks associated with emissions of CO_2 and other greenhouse gases, the health effects of chemical releases, the problems of including subjective perceptions of risk, and the inclusion of external costs. Significant uncertainties still exist in a number of areas, for example with regard to the risks of CO_2 emissions and the effects on the average temperature, and the risks of small releases of chemical substances. However, the discussion on external costs led to the important conclusion that if greenhouse effects are included in the assessment, hydro power and nuclear power are the only currently available large scale energy sources that have relatively low external costs.

A project was initiated in 1995 on the comparative health and environmental impacts of solid wastes from energy systems and other sources. Five tasks are planned: compiling and reviewing information on waste streams and disposal concepts for energy system fuel chains and other sources; identifying available methods for the assessment and comparison of the health and environmental impacts of radioactive and non-radioactive substances; identifying the available environmental fate and transport models that may be used for comparative assessments; documenting comparative assessments of the potential health and environmental impacts of radioactive and non-radioactive solid wastes from nuclear and other energy systems; and co-ordinating case studies comparing the health and environmental impacts of radioactive and non-radioactive solid wastes from nuclear and other energy systems.

FOOD AND AGRICULTURE

Regular Budget expenditure: $12 197 167

Expenditure by subprogramme



Extrabudgetary programme resources utilized (not included in chart): $3 592 205
(of which the sum of $1 677 290 is from FAO)

The Agency's food and agriculture programme assists Member States in improving food security through sustainable and environmentally friendly agricultural development. It does so by enhancing their capacity to use nuclear methods across a wide range of commodities and agroecological zones, with emphasis on improving crop and livestock productivity, food safety and food quality. The programme is operated jointly with FAO and implemented by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, and by the FAO/IAEA Agriculture and Biotechnology Laboratory at Seibersdorf.

Restructuring within FAO resulted in the upgrading of joint activities to the status of a programme within FAO's Agriculture Department. This offered the opportunity for strengthening the complementarity and co-ordination of work with other FAO divisions and, together with the Agency's Programme Performance Assessment System (PPAS), provided focused strategy, objective and task setting within each subprogramme. In addition, it permitted the development of time-frames and milestones for the attainment of specific objectives.

A feature of the work in 1995 was the increasing involvement of modern biotechnologies, such as nuclear based molecular methods, in vitro culture techniques and monoclonal antibodies. The value of including these methods in sterile insect technique (SIT) approaches to integrated pest management, mutation plant breeding programmes and diagnostic tests for animal diseases is already clear from the successes achieved in Mediterranean fruit fly and rinderpest control and eradication activities. The continued transfer of these methods over the past year and their expanded role in training, analytical and research support activities at the Agency's Laboratory are helping to improve knowledge and the capacity in Member States to tackle important issues, and represent an important investment towards future achievements.

Soil Fertility, Irrigation and Crop Production

A major thrust was optimization of the use of plant nutrients and water for sustainable crop production, with one approach being the identification of crops to suit the soil

and environment. Under a recently completed CRP funded by the Swedish International Development Agency (SIDA), several genotypes of wheat were identified in Morocco and Tunisia using the neutron moisture meter technique. These genotypes were highly efficient in utilizing limited amounts of water. Two of these, 'Massa' and 'Sarif', also had high grain yields. In addition, several provenances of the gum arabic tree *Acacia senegal* were shown to grow well in Sudan, where water availability is limited. On the basis of these results, a provenance from the Qoz Ashgar Forest of southern Sudan is now being recommended for introduction into the gum belt for its rehabilitation.

In Kenya, 22 provenances of *Acacia*, *Prosopis* and *Casuarina* were screened for drought tolerance in a semi-arid site in Machakos. The results showed significant differences in water use efficiency and dry matter yield. For example, *Acacias* from the Middle East and neighbouring north eastern African countries had greater drought resistance than those from other regions of Africa, while provenances from Costa Rica and Senegal were the best for *Prosopis* and *Casuarina*. An interesting feature demonstrated in this programme was that carbon-13 isotope discrimination is closely correlated with water use efficiency and the dry matter yield of a crop. This technique can thus be used in future research for the rapid screening of crop and tree species for high water use efficiency and high yield.

Another CRP completed in 1995 identified the growth stages of maize, wheat and cotton that are more resistant to drought. It was shown that 'water stress' during certain growth stages of field crops may not necessarily result in significant yield reductions. For example, research in Brazil, Egypt and Romania showed that cutting down irrigation at the vegetative stage did not reduce the yield of maize. In China and Morocco, wheat produced the same yields even when irrigation was reduced at tillering or at maturity. These results have important implications for increasing the efficiency of water use in crop production, since by reserving water which would otherwise be used during the more drought resistant stages, optimum crop growth and yield can still be obtained with minimum water inputs.

Plant Breeding and Genetics

Significant results were achieved during 1995 in the use of radiation induced mutants for increasing crop production. In the Altiplano of Peru, small farmer fields are located at more than 3600 m above sea level. This is a very stress-prone area characterized by short vegetation periods, droughts and morning frosts. Agency supported efforts by the National University of Agriculture, La Molina, to improve barley, which is the main crop that is grown there, made use of mutation techniques. A high yielding, 'naked' grain and extremely early mutant was selected from gamma ray irradiated seeds. This mutant was officially released as a new barley variety in May 1995 and its use is foreseen in large scale commercial production. In addition to improved adaptability, this variety's naked grains are very well accepted by consumers for preparing the traditional foods of the Altiplano.

In China, work on radiation induced mutations has been supported for many years through various FAO/IAEA CRPs. With assistance provided in 1995 through a technical co-operation project, rice breeders from the China National Rice Research Institute and Zhejiang Agricultural University started to grow rice mutant varieties in five provinces along the Yangtze River — the main rice growing areas in China. In total, nearly 600 000 hectares of early season rice were cultivated with mutant varieties, which gave an increase in rice production of about 263 000 tonnes over the best varieties grown in certain provinces. The total gain to farmers was estimated at $50 million, calculated on the basis of the official price of rice on the international market.

African farmers will soon benefit from new mutants of sorghum, African rice and cassava which were developed through a recently completed FAO/IAEA CRP supported by the Government of Italy. For example, in Mali several stable mutants of sorghum were developed with long panicles and better grain and drought tolerance, along with white grain mutants of African rice (white grained varieties have a higher market value than the normal red grain types).

The use of in vitro culture techniques for the improvement of vegetatively propagated crops in combination with radiation induced mutations has proved to be of immense value for producing the desired variation and in enhancing the selection of mutants in a disease-free condition. In Ghana, cassava mutants were selected for improved cooking quality and production of the traditional native dish 'fufu'. These mutants have larger starch granules, higher tuber yields and greater resistance to diseases.

At an FAO/IAEA international symposium on the use of induced mutations and molecular techniques for crop

improvement, held in Vienna in June, there was confirmation that radiation induced mutations followed by the appropriate selection procedures have been instrumental in improving the performance of germplasm throughout the world, since by 1995 nearly 1800 mutant varieties had been officially released in 52 countries. In fact, mutant induction and the understanding of mutations at the molecular level and in biochemical terms are now the basis of much present day research in plant breeding and genetics. As supporting tools for conventional breeding, molecular techniques therefore have the potential to assist in increasing productivity, improving quality and developing new raw materials for industry.

Animal Production and Health

The results of a recently completed CRP involving 13 Latin American countries documented the benefits to milk production and growth of supplementing cattle diets with a variety of non-traditional sources of protein, such as leguminous trees, poultry manure and urea–molasses blocks; similar information was obtained in Asia and Africa. For example, village based systems were developed in Indonesia to produce urea–molasses blocks which were distributed to farmers and resulted in weight gains of up to 0.5 kg per week in fattening animals and two to three litres per week in dairy cows. Similar gains were made in Sudan through feeding a supplement derived from the residues of sorghum and groundnuts, while even greater improvements were made in Morocco through the supplementation of silage with fish waste and molasses.

Support was given to Member States in Africa and Asia for serological monitoring of mass vaccination campaigns against rinderpest using an FAO/IAEA immunoassay test for rinderpest antibodies. This testing has shown that vaccination cover has produced sufficiently high levels of immunity in the national herds of most countries to warrant cessation of mass vaccination. This will lead to annual savings of several hundred million dollars. These countries will now proceed along an agreed pathway towards international declaration of freedom from disease, which will involve surveillance backed up by immunoassay and molecular based diagnostic tests to identify and stamp out the remaining few areas where the virus has survived. The tests were transferred to national veterinary laboratories in 1995 to assist in the task of final eradication.

Trypanosomiasis control and eradication programmes were monitored in 14 African countries using an enzyme linked immunosorbent assay (ELISA) test developed by the International Livestock Research Institute and at the FAO/IAEA Laboratory at Seibersdorf. On the island of Zanzibar, United Republic of Tanzania, the use of this assay has been crucial in supporting the SIT based tsetse eradication project. The assay provides a sensitive indicator of the presence of trypanosomes in the blood of cattle in the sterile fly release area, and hence of the presence of tsetse flies which, at low density, cannot be detected by present trapping methods.

Pilot quality assurance programmes were initiated by the FAO/IAEA Laboratory at Seibersdorf in 1995 to monitor the reliability of the results obtained through the use of radioimmunoassay (RIA) and ELISA tests provided to Member States. A high level of competence was shown by most participating laboratories.

Insect and Pest Control

Substantial progress was made in the eradication of the tsetse fly from the island of Zanzibar. Activities within a CRP and research at the FAO/IAEA Laboratory at Seibersdorf to improve the sterile tsetse fly rearing system, as well as the completion of the second phase of the refurbishment of the Tanga mass rearing facility on the Tanzanian mainland, led to an increase in the fly colony from only 40 000 at the beginning of the year to over 400 000 at the end of 1995. In addition, the laboratory at Seibersdorf continued monthly shipments of pupae in support of the project. These intensified releases of sterile flies over the southern part of the island, where the highest tsetse fly populations are located, had the effect of drastically increasing the sterile to wild fly ratio to over 200:1. Most wild females trapped now show signs of induced sterility and the wild population is rapidly disappearing. Sterile fly releases are being extended to the central part of the island and, when refurbishment of the third insectary of the Tanga facility is completed, releases of sterile flies can be expected to cover the entire island.

An SIT Mediterranean fruit fly (medfly) eradication project in Chile culminated in the eradication of this pest from that country, with benefits to the economy estimated at $500 million per year. Although the southern and central regions of Chile were already free of fruit flies and the country had developed a very successful fruit export industry, its produce was still being restricted from certain markets because of a fear of outbreaks as a result of the presence of the medfly in the Arica region of

northern Chile. After a decade of unsuccessful attempts to eradicate the fly using insecticides in this region, the Chilean Agricultural Service requested technical support from FAO and the Agency to establish an SIT eradication programme. As a consequence, a medfly mass rearing facility with a production capacity of approximately 60 million sterile flies per week was completed in 1993, when sterile fly releases were initiated. No wild medflies have been detected in the Arica region since the first half of 1995. In addition, the pest has been suppressed in Tacna, the southernmost valley of Peru. Future collaboration within an expanded FAO/IAEA bi-national Chile–Peru project foresees enlarging the eradication and control activities to other fruit producing valleys in southern Peru.

The year also saw the introduction of genetic sexing strains into large mass rearing facilities for SIT control of the medfly. This represents significant progress in the use of these strains, which were developed at the FAO/IAEA Laboratory at Seibersdorf over the last ten years. The white pupal colour sexing strain was introduced into the eradication programme in Argentina, with large scale releases planned for early 1996. Support activities for a medfly SIT programme in Guatemala also gathered momentum with the supply of the temperature sensitive genetic sexing strain.

Agrochemicals and Residues

Assistance continued to be provided to regions where agriculture has been affected by radionuclide contamination from the Chernobyl accident. In Belarus, research has shown that rapeseed oil essentially free of caesium-137 can be produced on land contaminated to a level of 0.5–1.5 TBq/km^2. Some 10 000 hectares were sown with rapeseed in 1995 to produce oil for lubricant manufacture and it is intended to increase the area by three to four times in 1996. This will provide a valuable cash crop for areas where the production of food with acceptable levels of radionuclides is uncertain. In Ukraine, assistance was given to improve the facilities for monitoring radionuclide contamination at a milk canning factory.

Experimental protocols for studying the effects of pesticides in non-target organisms in tropical agroecosystems, developed at the FAO/IAEA Laboratory at Seibersdorf and the Swedish University of Agricultural Sciences and funded by SIDA, were validated through a CRP involving African research institutes. The focus of efforts was on the insecticides lindane and endosulfan which are the two most commonly used organochlorine compounds. Both were shown to dissipate much faster in hot, moist tropical environments than in temperate conditions and it was probably for this reason that there was no evidence of serious environmental impacts resulting from their use (e.g. on natural enemies of pests). Soil organic matter breakdown was reduced, but this was not likely to influence long term soil fertility. These results are highly relevant for pesticide regulatory authorities in the participating countries who normally must depend on information generated in Europe or North America which may not be appropriate to African conditions.

Food Preservation

Through a seminar convened by the International Consultative Group on Food Irradiation (ICGFI) and the Secretariat of the Association for Southeast Asian Nations (ASEAN), a unified position was recommended to individual ASEAN governments for consideration regarding the regulation of food irradiation and acceptance of this technology to overcome trade problems in the region.

Among the tasks of a workshop convened by the ICGFI, with the endorsement of the World Trade Organization, was clarification of the implications of the trade in irradiated food, the various provisions of the Agreements on the Application of Sanitary and Phytosanitary Measures (SPS) and the Technical Barriers to Trade (TBT), adopted during the GATT Uruguay Round. On the basis of earlier recommendations by the ICGFI, the United States Department of Agriculture announced in 1995 that it will issue a new regulation to take effect in 1996 permitting irradiation as a quarantine treatment of fresh fruits and vegetables against major fruit fly species without a restriction on host commodities. Such a regulation should facilitate wider international trade in irradiated fruits and vegetables.

Results from a recently completed CRP showed that if irradiation is combined with other processes (e.g. low pH, low water activity, and a modified atmosphere), the radiation dose can be reduced and significant improvements made to the safety and quality of treated products. In addition to individual food items (e.g. fruits, vegetables, meat, and seafood), composite foods such as sausages, kebab and prepared meals also benefited significantly from the combined treatment. In some instances, combined treatment resulted in shelf stable products which were not only highly palatable but had modest energy requirements for production, storage and distribution.

HUMAN HEALTH

Regular Budget expenditure: $7 056 738

Expenditure by subprogramme

Nuclear medicine	*$1 460 491*	
Applied radiation biology and radiotherapy	*$960 513*	
Dosimetry	*$1 928 727*	
Nutritional and health related environmental studies	*$2 235 996 + $471 011 (IAEA-MEL):*	*$2 707 007*

Extrabudgetary programme resources utilized (not included in chart): $1 667 542 (including IAEA-MEL)

Agency activities in the area of human health focus on the common concerns of developing Member States that can be most effectively addressed using nuclear technologies. The programme promotes the diagnosis as well as palliative and curative treatment of cancer, the accurate evaluation of nutritional deficiencies in women and children, the timely detection of infections and communicable diseases, and radiation dosimetry. Advances in molecular biology facilitated the introduction in 1995 of a new area of work centred on genetic disorders which, together with other programme components, such as nutritional studies, is giving increasing emphasis to aspects of preventive medicine.

Nuclear Medicine

Agency efforts to adapt nuclear medicine technology to the needs and local conditions in Member States and to significantly reduce the costs of procedures have included the introduction of bulk methodology and the indigenous production of reagents for radioimmunoassay (RIA). These techniques give a four fold to six fold cost reduction per assay in many developing countries. Similarly, the hardware interfaces and applications software developed by the Agency to link gamma cameras to personal computers for digital data and image processing — obviating the need for costly hardware — make possible a three fold to five fold cost reduction in data processing systems. A limited field trial that started in 1995 is seeking to document these savings.

The Agency has also served indirectly as a catalyst in promoting the production by commercial firms of simple, low cost gamma cameras and single photon emission computed tomography (SPECT) systems, fitted with updated technology, to suit the needs of developing countries. The benefits are increased availability of equipment to Member States and lower costs for technical co-operation projects.

In related work, an inexpensive on-line circuit for field uniformity and photon energy correction has been used to upgrade and restore old, non-operational, analog gamma cameras to working condition. Efforts were initiated in 1995 to repair three 10–15 year old gamma cameras of this type in Argentina, India and Myanmar as part of a plan to upgrade to digital technology or to restore as many old analog gamma cameras as possible. It is estimated that there are about 500 such instruments (more than 65% of which are in developing countries) which can benefit by this upgrading.

Technical co-operation projects were initiated in Ethiopia, The Former Yugoslav Republic of Macedonia and Uganda in 1995 for the production of radiopharmaceutical kits in hospitals. The goal of these projects is to help reduce costs and increase self-reliance.

A randomized clinical trial comparing strontium-89 and phosphorus-32 for the treatment of painful cancer deposits in bone is being conducted to find out whether phosphorus-32 (which is inexpensive and easily available) can replace strontium-89 (which is expensive and not easily available). This study underlines Agency efforts to promote relevant, cost effective and applicable techniques for use in developing countries. The same philosophy is at the root of a recently completed CRP comparing scintigraphy and ultrasonography for the diagnosis of liver diseases.

The Agency has adopted a two level approach to improve the technical skills of nuclear medicine professionals. At one level, a pilot distance training programme for nuclear medicine technicians is being carried out in countries of the RCA region (i.e. India, Indonesia and Malaysia). When completed in 1996, the training materials will be translated into various national languages and will be utilized by more than 3000 technicians presently working without any formal training at nuclear medicine departments in developing Member States. The materials can also be used to complement existing or planned training courses conducted by Member States.

At another level, the Agency has served as a catalyst in the establishment of the Ibero-American Board for the Certification of Nuclear Physicians by the Latin American Association of Societies of Nuclear Medicine and Biology (ALASBIMNM), as well as in the implementation of the first certifying examination in November 1995. The examination was simultaneously carried out in Argentina, Bolivia, Chile, Ecuador, Portugal and Spain. The creation of this Board served as a stimulus for the setting up of the European Board of Nuclear Physicians. At present, the Agency is promoting the foundation of a similar board for the Asia and Pacific region by the Asia and Oceania Federation of Nuclear Medicine and Biology. In the future, it is expected that the three regional Boards will be bound together by a single international body dedicated to developing common question papers that will increase the fairness and validity of examinations for nuclear medicine professionals.

The diagnosis of genetic diseases using radionuclide based molecular techniques is acquiring greater importance as a result of changes in disease patterns observed in many developing countries. Improved socioeconomic conditions have led to a decrease in infant and childhood mortality rates, which in turn have resulted in an increase in the incidence of genetic (hereditary) diseases. A CRP initiated in 1995 concentrated for the first time on diagnostic methods for common hereditary diseases, such as thalassemia, fragile x-syndrome and certain neurological diseases.

A CRP on nuclear investigations of cerebral function was completed during the year. One beneficial result was that it helped to rationalize the use of certain drugs, such as Nicerogoline, Indobufen and Tanakan, for patients with cerebrovascular disease. It also provided scientific documentation of changes in regional cerebral blood flow following acupuncture.

An international symposium entitled *Tomography in Nuclear Medicine — Present Status and Future Prospects* was held in August in Vienna. The symposium highlighted the increased use of SPECT to obtain data on patients which was hitherto only possible using the much more expensive technique of positron emission tomography. The proceedings will be published in 1996.

Applied Radiation Biology and Radiotherapy

Special emphasis is being placed on increasing the efficiency and improving the cancer cure rate in radiotherapy units in developing Member States. Since up to 80% of new cancer cases in these countries are detected at the advanced disease stage, the following three converging avenues were selected for attaining these goals:

- Developing a standardized programme on quality assurance, including every step in the clinical procedure from patient selection to radiation dose delivery;
- Evolving optimal protocols for the treatment of advanced cancer types common in developing countries by twinning radiotherapy departments in developing countries with corresponding departments in developed Member States;
- Implementing randomized clinical radiotherapy trials combined with other treatment modalities for different types of advanced cancer.

Significant cost reductions in radiation therapy have been achieved as a result of the Agency's mediation with commercial manufacturers in the production of simple, inexpensive, after-loading systems for low, medium and high dose rate brachytherapy, combined with updated technology to fit the needs and conditions in developing

countries. Efforts are being made with other firms for the production of low cost teletherapy cobalt-60 equipment.

In an attempt to solve common problems affecting the practice of radiotherapy around the world, and in developing countries in particular, a new CRP was initiated on the use of radiotherapy in advanced cancer. Because the majority of the approximately 10–11 million new cases diagnosed worldwide every year occur in developing countries, the aim of this CRP is to interface radiotherapy departments in developed and developing countries in order to formulate optimal therapeutic approaches to the treatment of common cancers. Three protocols are undergoing trials in this CRP: one for half-body irradiation techniques, and one each for cancer of the uterine cervix and intraluminal brachytherapy for carcinoma of the oesophagus.

There was also emphasis on encouraging quality assurance programmes in clinical radiotherapy departments. A new CRP on quality assurance in radiotherapy was started in Latin America on the basis of a protocol recommended by a team of Agency experts. It is expected that the experience from this project will assist the Agency in defining a standardized programme on quality assurance which could be adopted by interested radiotherapy departments among Member States and, in particular, by the participants in 65 ongoing technical co-operation projects on the subject.

A CRP was initiated in 1995 on the application of heavy charged particles in cancer radiotherapy. Only a few centres, mainly located in developed countries, currently possess such facilities. This CRP is expected to provide a much needed *international* forum for the review and co-ordination of national programmes on the use of heavy charged particles in radiotherapy.

Dosimetry

Radiation dosimetry and medical radiation physics are fundamental in ensuring a patient's radiation safety and in optimizing radiation therapy practices. The main emphasis in the field of dosimetry was on continuing and improving the services provided to Member States.

Following the establishment of facilities and a syllabus for a national training programme in medical physics in Mexico, these activities were upgraded in 1995 to the category of a model project for Latin America. The aim is to replace simpler professional training with post-graduate university degrees in medical physics. The lessons learned during the implementation of this project will be applied in other Member States.

The number of IAEA/WHO Secondary Standard Dosimetry Laboratories (SSDLs) rose in 1995 to 73 laboratories and 6 SSDL national organizations in 58 Member States; it also includes 14 affiliated members, mainly Primary Standard Dosimetry Laboratories (PSDLs), the International Commission for Radiation Units and Measurements (ICRU) and other international organizations. Support to laboratories in Member States included calibration of their secondary standards for radiation measurements and quality audits of their services, mainly to radiotherapy installations.

As the central point of the network and as the link to the international measuring system, the Agency in 1995 provided calibrations of 22 reference ionization chambers and dosimeters for 12 SSDLs. A total of 59 ionization chambers belonging to SSDLs and hospitals were calibrated (i.e. 410 calibration points at different radiation qualities). The quality audit system based on mailed thermoluminescence dosimeters (TLDs) was used for 6 SSDLs to verify their calibrations of cobalt-60 therapy units and medical accelerator radiation beams.

A new service was begun in 1995 to develop procedures for the calibration of radiation sources used in brachytherapy and related measurement equipment, first at the Agency's dosimetry laboratory at Seibersdorf and later at SSDLs. This unique service is meant to extend the traceability of does delivered in brachytherapy treatments to international standards.

The IAEA/WHO TLD postal service distributed 425 thermoluminescence dosimeters to radiotherapy centres in developing Member States. These dosimeters are used for dose quality audits of photon and electron beams for cobalt-60 therapy units and medical accelerators. In addition, results from 100 cobalt-60 beams and 134 accelerator photon and electron beams were processed during the year.

Testing of the new method of using TLD dose checks of electron beams was completed in 46 radiotherapy institutions in Europe and the USA, and procedures were developed to expand the TLD postal service to routinely include electron treatment beams. Part of this work was carried out in collaboration with the SSDLs of Argentina and India using Agency technical expertise. Procedures for the follow-up of hospitals that are outside the acceptance limits now include a user-blind repetition of the exercise.

Experts are now being recruited to resolve confirmed deviations.

The International Dose Assurance Service (IDAS) for industrial dosimetry in radiation processing facilities was continued. A new batch of alanine-ESR dosimeters was calibrated with traceability to the National Physical Laboratory, the PSDL in the United Kingdom. Sixty-eight dosimeter sets were distributed to 20 participating institutes from 16 Member States. This service has, since its initiation, been limited to cobalt-60 radiation. However, following the recommendations of a CRP on electron dosimetry, a transfer dosimetry system for electrons with energy higher than 4 MeV based on alanine-ESR is being implemented to extend the IDAS to electron beams. In related work, a study is being conducted to evaluate the therapeutic use of the alanine-ESR dosimetry system, which is already being used very effectively in industrial applications.

An intercomparison of gamma ray irradiation beams between nine calibration laboratories, organized in collaboration with the Bureau International des Poids et Mesures, was completed. The last such intercomparison was held about ten years ago. The standard deviation of the population was 2.1% at 15 kGy and 2.4% at 45 kGy. The Agency's value agreed with the mean value to within 1% for both dose levels. In practice, this means that variations between the nine calibration laboratories are very small and that their overall deviation from the Agency's mean value is even smaller.

A new Agency Code of Practice for the calibration and use of plane parallel ionization chambers in therapeutic electron and photon beams was submitted for publication. This document complements and updates the 'IAEA Protocol' for the calibration of clinical beams used in external radiotherapy (Technical Reports Series No. 277), which is the Code of Practice most widely used in Member States.

Nutritional and Health Related Environmental Studies

Malnutrition afflicts more than 800 million people in developing countries, with children and women during pregnancy being most affected. Nutrition is therefore one vital area of human health where nuclear techniques can be applied to prevent disease and help people achieve their full potential. An essential component of any intervention seeking to improve nutritional status is the ability to perform accurate evaluations. Isotopic tracer techniques are unique in that they can be used to measure people's nutritional stores and predict long term outcomes, such as school performance, worker productivity, pregnancy outcome, morbidity and mortality. Their growing use should increase the cost effectiveness of intervention programmes, because programmes can be adapted and corrected during the early phases to the results of the early predictors. In addition, they can reduce the population sample size to obtain statistically significant information because the coefficient of variation of isotope measurements is considerably smaller than that of conventional measurements.

Nuclear techniques are being used for the first time to measure vitamin A reserves in people at risk of deficiency. This programme has led to a major collaborative effort involving the Agency, WHO and two Member States. Another project is under way in Peru to evaluate the nutritional impact of a national school breakfast programme which is delivering breakfasts each school day to 500 000 children over a four year period.

Significant progress was achieved in 1995 through improved quality management in environmental programmes using nuclear analytical techniques, particularly in a regional RCA programme supported by UNDP. New quality assurance materials and proficiency testing procedures have been developed with the assistance of the Agency's Laboratory at Seibersdorf, and a comprehensive new database on certified analytical reference materials has been created (which will shortly be made available on the Internet). For air pollution studies, a standard design air sampler is now operational in more than 30 Member States. This will, for the first time, allow accurate comparative data to be obtained on pollution levels and sources in a large number of developing Member States.

A gas chromatograph–isotope ratio mass spectrometer was installed in 1995 at IAEA-MEL. This instrument is being used to 'fingerprint' non-nuclear pollutant sources and to search for novel chemical markers of pollution.

Within the framework of an umbrella project with UNEP, IAEA-MEL provided comprehensive technical support in the assessment of marine pollution. Regional training courses were held in Morocco, Peru, the Russian Federation and Ukraine. Courses in Monaco were conducted on the analysis of trace elements and organometals, organochlorine compounds and petroleum hydrocarbons. Twenty advisory and technical missions

were carried out in 13 countries. Instrument maintenance services were also provided to ten Mediterranean Pollution (MEDPOL) laboratories in seven Mediterranean countries.

The preparation of IAEA–UNEP–IOC reference methods and technical bulletins for marine pollution studies was given high priority. Thirteen methods were revised, eight new methods were issued, two methods were translated and one technical bulletin was prepared. The series now includes over 65 volumes.

Activities in the Analytical Quality Control Services programme included the distribution of a sea plant homogenate (IAEA-140) to 207 laboratories worldwide for the intercomparison of organic contaminants. In addition, two intercomparison samples for the determination of trace elements in biota and sediments (MA-MEDPOL-1/TM and SD-MEDPOL-1/TM) were distributed to 80 laboratories in the Mediterranean Sea area. They were specifically organized for MEDPOL laboratories in order to test the reliability of procedures and the viability of analytical data, as well as to target future areas of technical support.

A report on worldwide and regional intercomparisons for the determination of organic contaminants in Mussel Homogenate (IAEA-142) was completed. In total, 93 laboratories reported results for organochlorine compounds and petroleum hydrocarbons, and 12 laboratories reported results for the quantity of total mercury and methyl mercury. On the basis of the data evaluation, the IAEA-142 sample can now be considered for certification as a Reference Material for the above analytes.

INDUSTRY AND EARTH SCIENCES

Regular Budget expenditure: $3 875 955

Expenditure by subprogramme

Industrial applications	*$987 921*
Water resources development	*$2 888 034*

No extrabudgetary programme resources

Agency activities in 1995 in the area of industry and earth sciences concentrated on applications of nuclear and radiation techniques in the industrial sector and on the utilization of isotope hydrology in water resources development and environmental management. In industrial applications, emphasis was placed on process control optimization, development of materials with improved performance, quality assurance modalities of materials through non-destructive testing, environmental mitigation using radiation technology and monitoring of industrial pollution. The increased importance given by Member States to the use of isotope techniques in water resources development and management has provided fresh momentum to Agency efforts. The management of water resources in regions suffering from scarcity, the assessment of the human impact on water resources, such as water pollution, and the proper use of geothermal water resources were all important areas of activity. Complementary studies on climate change were also pursued.

Industrial Applications

Radiation processing is being recognized as an 'environmentally friendly' technique because it replaces other processes that create pollution and actively contributes to the protection of the environment. This is well demonstrated by the use of electron beam radiation to clean flue gases from coal and oil burning electrical and heat generation plants. The technique has been effectively demonstrated in several countries, some with support from the Agency (e.g. in Poland). The main accomplishment in 1995 was a feasibility study and the selection of basic irradiation equipment for a full scale electron beam industrial facility in Poland. This facility is expected to be in operation by 1998 to meet the regulatory requirements in effect at that time. In addition, a pilot electron beam radiation plant and a larger scale model project plant in Poland were being used for training activities.

The stability of plastics under irradiation has been under study in a CRP that started in 1994. The subject has importance for the safe operation of nuclear power plants, in industrial radiation facilities, space exploration, sterilization of medical products and other fields. In 1995, a Research Co-ordination meeting focused on several aspects of polymer irradiation, in particular the stabilization of plastics used by the medical products industry and in radiation sterilization (i.e. of syringes, needles, blood and infusion sets). New techniques for the characterization of polymer surfaces (atomic force microscopy) were presented at this meeting, as were new formulations that remain stable under irradiation.

The substantial role that nuclear technology can play in environmental conservation is illustrated by the variety of nuclear techniques now being used in the exploration and exploitation of natural resources such as coal, oil, gas and minerals. For example, the significant economic benefit that can be derived from being able to subdivide large quantities of waste materials into a class of usable

materials was the guiding principle behind a CRP which was concluded in 1995. This CRP examined the use of gamma measurements as an aid in separating usable waste material from non-usable products. Other topics investigated were the removal of heavy toxic metals from liquid industrial wastes, the validation of the containment of solid wastes, separation processes for the efficient removal of toxic compounds from bulk wastes, and monitoring of process wastes to determine their eventual reuse or method of storage. The results of these investigations will be published in an Agency technical document.

Development of Water Resources

The Agency's symposia on isotope hydrology, usually held every four years, play a major role in disseminating new achievements in the development and application of isotope techniques in hydrology, water resources management and associated environmental disciplines. The ninth symposium was held in March in Vienna with an emphasis on the practical applications of isotope techniques in managing groundwater resources. Two-thirds of the papers and posters presented at the symposium were related to such subjects as the origin and recharge of groundwater, groundwater dynamics, groundwater pollution, modelling approaches, and geothermal and palaeowater resources. The remaining contributions dealt with surface water and sediments, unsaturated zones and methodological aspects.

In order to maintain the requisite level of training for the proper implementation of water resources development projects, the Agency has been convening group fellowship training courses every two years for scientists from developing Member States. The fifth such course was held in Vienna from August to October and the participants received training in the principal fields of isotope hydrology. Special emphasis was placed on practical training in laboratory and field work, carried out in Vienna, Graz and Munich, as well as in the use of computers for mathematical modelling and data processing.

In regard to progress achieved in implementing model projects in isotope hydrology, a project in Venezuela identified the sources of groundwater recharge in the Caracas Valley and assessed the vulnerability of the groundwater to pollution. On the basis of these studies, 15 new locations for drinking water wells were identified and successfully commissioned.

Within the framework of a regional model project for Africa on the use of isotopes in groundwater resources development (involving Egypt, Ethiopia, Morocco and Senegal), field investigations were carried out and water samples collected. These samples are being analysed in laboratories at the Agency and in India, France and the United Kingdom. First results from Moroccan isotope data indicate the prevalence of palaeowater, disproving the assumption that the groundwater system was recently replenished. This is a clear indication that continued overuse of this water will exhaust the available groundwater store, leading to a rapid decline of the water table. This has direct implications for decisions on water management practices.

The rising water level of the Caspian Sea is of considerable concern to the five states bordering this body of water. A technical co-operation programme involving a 15 day cruise was carried out in September, during which ten participants from the littoral states, three outside experts and two Agency staff members carried out studies pertaining to oceanographic, isotopic and chemical parameters of the water at different locations and at various depths. Close technical collaboration was established between the littoral states. Laboratory analyses are in progress and detailed evaluation of the data generated is expected to pave the way for a better understanding of the rise in water level and eventual remedial measures.

Several United Nations agencies and other specialized organizations are engaged in the study of global climate change. The Agency has been a pioneer in this area for more than 30 years, with a worldwide network that collects precipitation data and provides information on the isotopic composition of precipitation. In order to strengthen the foundation for collaboration between the various international organizations, the Agency convened a meeting in November at which a new framework for the involvement of various organizations was discussed. A newly established interagency steering committee is expected to coordinate activities and provide the necessary resources for the 'Global Network of Isotopes in Precipitation' (GNIP).

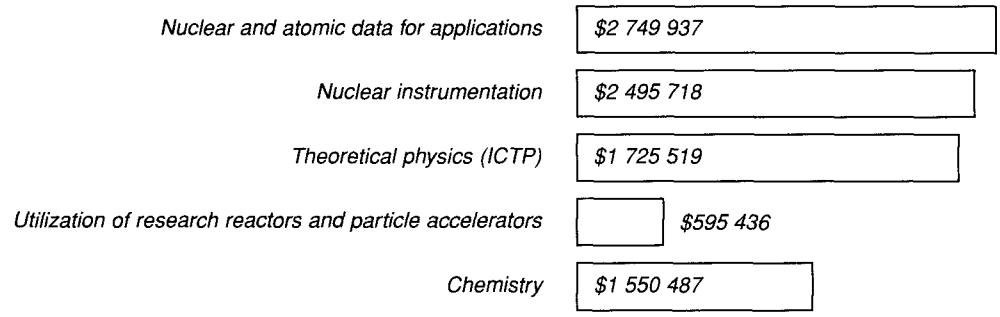
Considerable efforts have been directed towards improving predictions of climate changes induced by human activities and their impact on the global environment. One promising approach is the study of past climate changes through isotope investigations of climate archives. Isotope techniques have proved to be indispensable as proxy indicators of the climate and a dating tool for past climatic events. Substantial progress has been made in this field through a CRP on the use of isotope techniques in palaeoclimatology, with special reference to continental isotope indicators of palaeoclimate.

At the final Research Co-ordination meeting held in November in Munich, new data were presented on the concentration of noble gases dissolved in the groundwater of regional aquifer systems in North and South America, Europe and Africa. The evaluation of the data in terms of the air temperature difference between the Holocene and the Last Glacial Maximum provided a value of about 5°C for the tropical regions. This result challenges the widely adopted climatic reconstructions for low latitude regions and has important implications for global climate modelling studies. Isotope studies of lacustrine sediments from several lakes located in the Tibetan plateau provided evidence of large scale changes in the intensity of the Indian monsoon and associated rainfall during the Holocene period. This confirms the vulnerability of the climate in southeast Asia to relatively small changes in the physical parameters of the atmosphere.

PHYSICAL AND CHEMICAL SCIENCES

Regular Budget expenditure: $9 385 568

Expenditure by subprogramme



Extrabudgetary programme resources utilized (not included in chart): $ 22 017 700 (including ICTP)

The Agency's activities in the physical and chemical sciences cover the applications of nuclear and atomic data, nuclear instrumentation, theoretical physics, the utilization of research reactors and particle accelerators and chemistry. Specific services to Member States include the provision of databases, as well as the co-ordination and technical support of efforts to develop selected nuclear technologies. The nuclear and atomic data provided by the Agency are essential for calculations in the areas of reactor safety, radiation shielding, nuclear fusion research, medical procedures and industrial processes. In addition, many Member States receive assistance in the utilization of their research reactors and accelerators for the production of medical isotopes, in materials processing and environmental monitoring. In the area of nuclear instrumentation, the Agency recruits experts, conducts training courses and provides spare parts to help Member States select, utilize and maintain their instruments. Finally, the Agency is involved in the development of radiopharmaceuticals that will help in diagnosing medical problems and alleviating the pain of metastatic bone cancer.

Nuclear and Atomic Data for Applications

Internet access to the Agency's nuclear and atomic databases was improved in response to the rapid developments in computer networks. These databases provide accurate and up-to-date files for a variety of nuclear technology applications, such as reactor dosimetry and radiation safety, fusion reactor development, waste management, radiotherapy, and safeguards and material analysis. The use of on-line data retrievals increased by about 50% during 1995, benefiting several hundred end-users in 41 Member States. In addition to the enhanced on-line services, mail shipment continued of magnetic tapes, diskettes and printed materials to institutes in more than 80 Member States.

In order to support engineering design activities for the International Thermonuclear Experimental Reactor (ITER), an extensive fusion evaluated nuclear data library (FENDL-1) was validated and tested. In addition, three improved atomic and molecular databases for fusion were completed, including data for plasma edge studies, heavy element impurities in fusion plasmas and erosion of fusion reactor materials.

Five major nuclear databases were released under the auspices of the International Data Network of Nuclear Data Centres, two of which are useful in studies of the accelerator transmutation of actinides.

A handbook on atomic and molecular data for radiotherapy was published in response to the needs of the medical research community. This handbook contains the data needed to develop protocols for the radiotherapy of cancer and to design instruments and methods for the delivery of the desired doses with minimal damage to surrounding tissue.

Finally, a PC package of nuclear data for safeguards was developed. The value of this package is that it contains recent values of fissile material decay properties which are needed for fuel analysis.

Nuclear Instrumentation

The curricula of interregional training courses dealing with interfacing in nuclear experiments and radiation measurements for applications were revised to include information on new instruments and general trends in nuclear technology. These courses are designed to help developing Member States in the selection, use, maintenance and repair of nuclear instruments for applications in the fields of research, industry, the environment and medicine.

A rigorous comparison of 12 commercial and non-commercial software packages (including Agency codes) for gamma ray spectral analysis was carried out using standard spectra measured at the Agency. The results will provide Member States with valuable information on the performance, capabilities and limitations of software packages for gamma spectrometry. The Agency's Laboratory at Seibersdorf extended its capabilities in the area of X ray fluorescence (XRF) to include the assessment of environmental pollution and the analysis of rock phosphates. Methodological studies also included the development of optimized sample preparation procedures for the analysis of solid materials using the total reflection XRF method. As a result, the majority of solid materials can now be transferred into liquid form and analysed with a higher level of accuracy and sensitivity using total XRF.

In the area of nuclear electronics, the Laboratory was involved in the design and manufacture of special instruments and training kits, as well as in establishing or upgrading infrastructures for the repair and maintenance of nuclear instruments in Member States. Training programmes were offered in the maintenance and manufacture of nuclear spectroscopy instruments and XRF analysis.

Theoretical Physics

The 57 courses, 12 research activities, 1 training scheme and 1 lecture series that the ICTP organized in 1995 totalled about 5900 visits, 64% of which were by scientists from developing countries.

The organization of this unprecedented number of activities with a record number of visits was made possible by regular contributions from the Agency ($1 703 300), UNESCO ($373 500) and the Italian Government ($12 195 000), plus extraordinary contributions mainly by the Italian Government and the EC. Numerous other institutions were co-sponsors of the training for research activities.

Through its Office for External Activities, the ICTP supported 78 scientific meetings in 35 developing countries, 6 Networks of institutions in Africa, Asia and Latin America, and 10 Affiliated Centres in as many developing countries. Nineteen Visiting Scholars received financial support to visit institutions in 14 developing countries. The Department for Research Co-operation, SAREC, of the Swedish International Development Co-operation, Agency, has been the major source of funding for the ICTP's external activities for some years.

Under its Books and Equipment Donation Programme, the Centre distributed 75 000 items of scientific literature (journals, conference proceedings and books) to 500 institutions in 90 developing countries. In addition to the donations distributed directly by the ICTP, a large number of complete sets of back issues of journals were shipped directly by the donors to institutions in developing countries.

The 1995 ICTP Dirac Medal was awarded to Michael Berry (Royal Society Research Professor at the University of Bristol, United Kingdom) for his discovery of the non-integrable phase that arises in adiabatic processes in quantum theory. The 1995 ICTP prize in the field of high energy physics, in honour of Steven Weinberg, was awarded to Spenta R. Wadia from the Tata Institute of Fundamental Research, Bombay, India, for his contributions to high energy physics.

Utilization of Research Reactors and Particle Accelerators

An Advisory Group meeting was held in July in Ljubljana, Slovenia, on accelerator based nuclear analytical techniques for the characterization and source

identification of air particulates. The results from this meeting should help Member States utilize their accelerators more effectively for environmental monitoring in order to identify sources of air pollution, especially particulate matter.

Several years of Agency activities on low energy accelerators were reviewed and summaries were presented at a scientific seminar on accelerator applications during the regular session of the General Conference. The presentations described nuclear accelerator applications in materials research, industrial processes, sterilization, food irradiation, environmental monitoring, pollution abatement, and medical diagnostics and therapy.

Chemistry

The prevalence of metastatic bone cancer in nearly all countries has created the need to develop new therapeutic and palliative agents. It is estimated that about half of the patients with carcinomas of the prostate, breast and lung eventually develop skeletal metastasis. The Agency's contribution to the investigation of this problem has been a CRP on the reactor production of beta emitting radionuclides, e.g. samarium-153 and rhenium-186 among others, and their utilization as radiopharmaceuticals for the relief of bone pain resulting from metastatic bone cancer. In collaboration with nuclear medicine physicians, several clinical trials were conducted in participating countries, with promising results. It is expected that these trials will continue and that therapeutic radiopharmaceuticals will be made available on a routine basis in the near future for bone pain relief, as well as for other therapeutic uses of nuclear medicine.

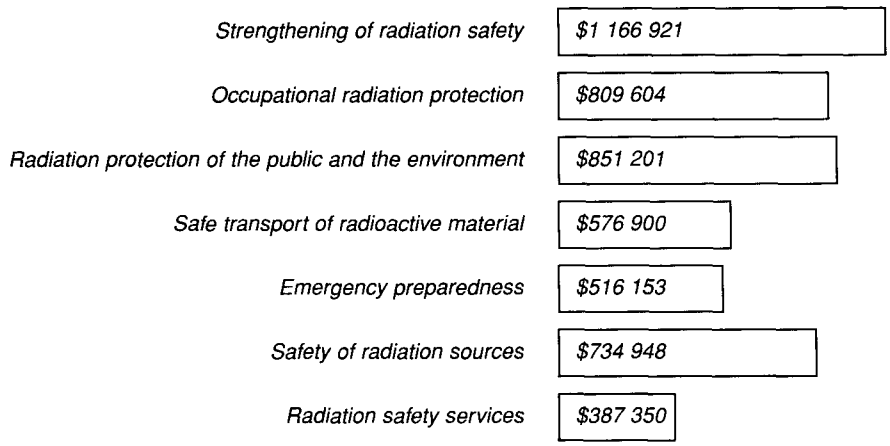
There is a need for analytically reliable and low cost radioimmunoassays (RIA) and immunometric assays (IRMA) in order to measure a variety of substances in biological fluids, particularly for national screening programmes for hyperthyroidism and infectious diseases. In response to this need, a CRP on the preparation of antibodies immobilized on magnetic particles was initiated in 1991 and completed in 1995. Reproducible and low cost procedures were developed and optimized for the preparation of several types of magnetizable particles, particularly for RIA and IRMA procedures, and their potential for routine use in the assay of thyroid hormones was demonstrated.

Activities in the Agency's Analytical Quality Control Services (AQCS) programme included the preparation of three new intercomparison materials, the evaluation of nine intercomparison studies and the preparation of a new AQCS catalogue. Sixty-four different reference materials were available; about 1100 units were distributed to laboratories in various Member States. The AQCS mailing list was updated and now contains about 6800 recipients.

RADIATION SAFETY

Regular Budget expenditure: $5 043 077

Expenditure by subprogramme



Extrabudgetary programme resources utilized (not included in chart): $233 077

The Agency's radiation safety programme encompasses research co-ordination, development and harmonization of safety standards, regulations concerning the safe transport of radioactive material, emergency preparedness procedures, practical assistance services, training and information exchange. Together, these activities provide a comprehensive and co-ordinated framework for promoting good radiation protection practices in Member States. The 1995 work programme focused on three activities. The first was a systematic document revision and elaboration process to help users fulfill the requirements stipulated by the new *International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources* (BSS) (jointly sponsored by the FAO, IAEA, ILO, OECD/NEA, PAHO and WHO). The second effort covered services and assistance to Member States in carrying out radiological assessments. The third area was the support of technical co-operation activities.

Strengthening of Radiation Safety

In the early 1990s, the Agency began preparation of a set of internationally agreed publications known as 'Safety Fundamentals', which form the top level of the Agency's Safety Series documents and cover three topical areas: the safety of nuclear installations, radioactive waste management and radiation protection. The Fundamentals relating to the safety of nuclear installations were issued in 1993. In 1995, work was completed on Fundamentals documents relating to radioactive waste management, and to radiation protection and the safety of radiation sources (the latter co-sponsored by FAO, ILO, OECD/NEA, PAHO and WHO — an important step forward towards global harmonization in radiation protection).

Radiation protection embodies a set of protection and safety objectives with corresponding principles for achieving safety. The principles elaborated in the Fundamentals publication include: justification of a practice; dose limitation and optimization of protection; measures to be taken to enhance operational safety; the rationale for intervention; and design and construction that ensure that a source is suited for reliable, stable and easily manageable operation. Further principles require governments to establish a legal framework for the regulation of practices and interventions, with a clear

allocation of responsibilities, including those of a regulatory authority.

During 1995, considerable effort was devoted to ensuring that appropriate guidance is available for three important areas of application of the BSS in routine operation, namely the protection of workers, members of the public and patients undergoing medical diagnosis or radiotherapy.

Extensive guidance on the protection of patients had not been issued previously by the Agency. With the increased emphasis given to this subject in the BSS, and the introduction of new concepts such as guidance levels for use in diagnostic radiology, preparation of general guidance on the interpretation of the BSS in this important area was initiated and is proceeding in collaboration with WHO and the international medical community.

To assist in the practical application of the new BSS, the Agency convened in November 1995 a seminar on advances in their implementation and experience in applying the 1990 recommendations of the ICRP. The technical sessions addressed such issues as: the protection of workers, patients and the public; potential exposure situations; emergency and chronic exposure situations; administrative requirements; exemptions; interventions; and national radiation protection infrastructures.

Occupational Radiation Protection

Protection of workers is a major issue in every country that uses radiation for medical and industrial applications. Preliminary efforts were made in 1995 to prepare guidance material on how to meet the requirements stipulated by the BSS so that all aspects of occupational exposure are covered, and on aspects specific to the assessment of internal and external exposures. In the development of this guidance material, attention is being paid to the recommendations of the ICRP and the ICRU.

Radiation Protection of the Public and the Environment

Agency guidance material on the protection of the public by limiting radioactive discharges to the environment was revised and brought into line with the BSS. The new document provides an explanation on how to develop, through a regulatory system, authorized discharge limits for various practices.

A conference, organized jointly with the EC and WHO, was held in April 1996 to coincide with the tenth anniversary of the Chernobyl accident. Preparatory work carried out in 1995 included an Agency sponsored project to assist scientists in Belarus, the Russian Federation and Ukraine to collect and analyse a wealth of scientific data not previously available to the international community. The results of this analysis will be presented at the conference.

The Agency undertook a review in 1995 of 19 000 km^2 of land in Kazakhstan where nuclear weapons were tested over a period of forty years. This region, known as Semipalatinsk, includes the town of Kurchatov and a number of other inhabited villages and farms. At the request of the Government of Kazakhstan, two Agency expert teams visited the site in 1993 and 1994 to determine the current hazards from living in the area.

Of particular concern were the atmospheric and surface tests carried out before 1962, five of which were unsuccessful and resulted in the dispersion of plutonium rather than a nuclear explosion. The major sites selected for field work by the teams were the settlements around the polygon of Dolon, Sharzhal and Kainar, with the settlement of Akzhar near Kurchatov as a reference site. Inside the polygon efforts concentrated on the so-called 'Atomic Lake Balapan', including the state farm in the vicinity of the lake, Ground Zero, and other sites of atmospheric and above ground explosions. Data collection activities included gamma dose rate measurements, in situ gamma spectrometry, and the gathering of soil, grass and milk samples, and biological indicators such as animal bones, mushrooms and moss.

The dose assessment included consideration of all relevant pathways, most importantly external gamma exposure from material on or in the ground, inhalation of material resuspended from the ground and consumption of contaminated food. The preliminary conclusions were that doses to local populations in the settlements are very low but that restriction of access to land with high dose rates, namely the Atomic Lake and Ground Zero, would be useful to prevent re-occupation. Further systematic studies are needed on plutonium levels in the soil and on the levels of radionuclides in drinking water sources. Overall, the results and dose assessments confirm that there is no need for concern among those living in the settlements around this test site.

Safe Transport of Radioactive Material

The Standing Advisory Group for the Safe Transport of Radioactive Material (SAGSTRAM) continued to advise

on the comprehensive revision of the Agency's regulations on this subject. The incorporation of a system of radiological protection that is consistent with the BSS was endorsed, including the establishment of exemption values. Six specialist meetings considered such areas as the requirements applicable to the packaging of uranium hexafluoride, criticality safety and alternative packaging for low level radioactive material. Specific provisions will require the use of highly accident resistant packaging when large quantities of radioactive material are transported by air.

Emergency Preparedness

Work began on updating the Agency's emergency preparedness guidance material in order to reflect recent experience, and to provide a harmonized set of emergency preparedness documents and opportunities for training. This is being accomplished by revising Agency guidance on the technical and programmatic elements of emergency response, developing practices that can be used to apply the procedures immediately, conducting training workshops on the practices, and using the updated material as a basis for technical co-operation efforts to enhance the emergency response capability of certain Member States.

Safety of Radiation Sources

The Agency's international inventory of major radiation sources, mainly industrial irradiators and radiotherapy sources, was further expanded to about 1000 records. Information on 55 accidents known to have occurred in radiotherapy centres and 9 accidents at industrial irradiation facilities has been analysed and will be published as guidance material to help prevent future occurrences. All of these accidents involved human factors, equipment failure and human–machine interface problems, consisting of the misinterpretation of conflicting signals and maintenance errors. In the radiotherapy cases, human factors problems dominated. Maintenance problems and deactivation of interlocks also played significant roles. The systematic incorporation of in-depth safety principles and feedback into training courses are measures that could be adopted to reduce the likelihood of such accidents.

Radiation Safety Services

A review of the Emergency Response Unit (ERU) began in 1995 with the aim of improving the Agency's ability to fulfill its obligations under the Conventions on Early Notification of a Nuclear Accident and on Assistance in the Case of a Nuclear Accident or Radiological Emergency. Operating procedures were critically analysed and steps were taken to modernize the communication system. Training was intensified on ERU stand-by and activation mode procedures.

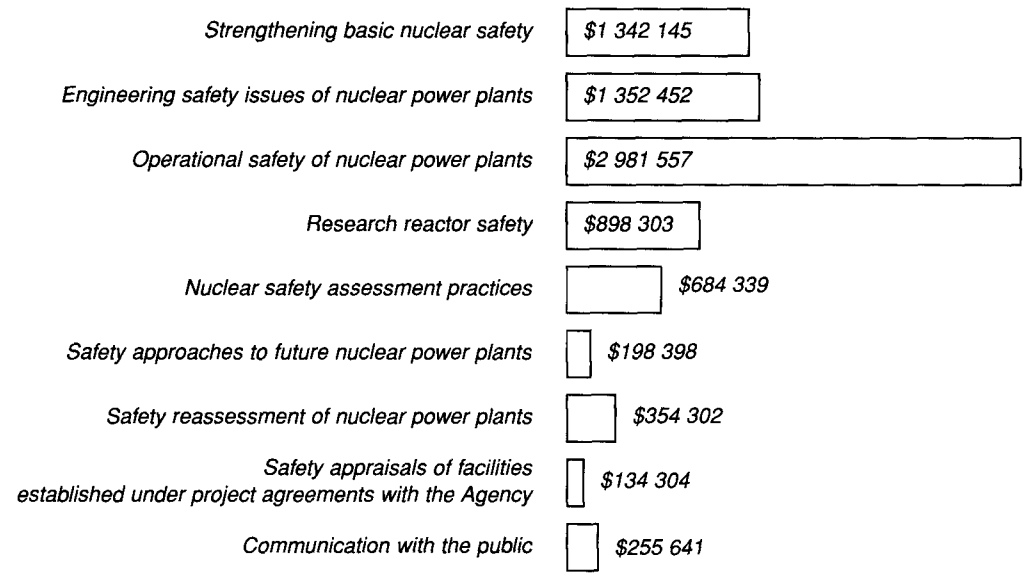
Monthly internal exercises were carried out on quickly assembling a team to respond to the initial notification of a nuclear accident or radiological emergency. External exercises involving Parties to both Conventions, Member States and other international organizations were held. These included participation in exercises with Lithuania, Romania and the Russian Federation, routine external communication exercises and an exercise to test the capability of WMO to rapidly provide the Agency with atmospheric transport predictions. An off-site emergency exercise in Guangdong Province, China, was reviewed. Co-ordination continued with other United Nations organizations that would have a role to play in responding to a nuclear accident or radiological emergency.

Personnel monitoring and other services, including in-house training, continued to be provided to Agency staff involved in safeguards activities and to other personnel. Such services were also extended to field experts classified as workers occupationally exposed to ionizing radiation. Equipment for the monitoring of external and internal radiation exposure, comprising thermoluminescence dosimeters and a whole body counter, was significantly upgraded to meet the Agency's internal needs. The Agency now has available a dosimetry laboratory which is equipped with state of the art technology. In addition, the Agency's radiation protection rules and regulations were revised in the light of the revision of the BSS.

SAFETY OF NUCLEAR INSTALLATIONS

Regular Budget expenditure: $8 201 441

Expenditure by subprogramme



Extrabudgetary programme resources utilized (not included in chart): $2 888 371

A strong and dynamic global nuclear safety culture continued to evolve and develop in 1995. This process was characterized by three main components: creation of binding international legal instruments; promotion of internationally harmonized, non-binding safety standards; and extension of the acceptance of international expert review and advisory services. The Agency continued to foster this global nuclear safety culture by supporting intergovernmental collaborative efforts: it provided a forum for extensive information exchange; promoted the drafting of international legal agreements and the development of common safety standards; and organized a wide variety of expert services. These activities were complemented by the sponsoring of co-ordinated research and development and the widespread dissemination of information on safety issues.

Strengthening Basic Nuclear Safety

The Convention on Nuclear Safety, opened for signature in 1994 and signed by 62 countries by the end of 1995, binds countries to basic principles covering the regulation, management and operation of land based civil nuclear power plants. One of the fundamental obligations is to establish and maintain an effective legislative and regulatory framework. A central requirement calls for national reports demonstrating the fulfillment of the various obligations at meetings held at least every three years. Entry into force of the Convention requires ratification, acceptance or approval by 22 countries, 17 with operating nuclear power plants. By the end of 1995, 14 countries had deposited instruments of ratification, acceptance or approval. In the light of expectations of a rapid

ratification process and entry into force in 1996, two informal meetings of representatives of signatories and other interested States were convened in Vienna during 1995, focusing on the conduct of the Meeting of the Contracting Parties, the structure of national reports and procedures for review.

The International Nuclear Safety Advisory Group (INSAG), consisting of leading experts in nuclear safety, continued to serve as a forum for the exchange of information and the provision of advice on safety issues of international significance. The Agency's General Conference endorsed a proposal for a common basis on which an acceptable level of safety for all operating nuclear power plants built to earlier standards can be judged. In response, INSAG prepared report INSAG-8. Another report (INSAG-9) discusses policy aspects, safety assessments, risk considerations and probabilities, and is intended to stimulate discussion and promote practical actions to enhance safety.

The comprehensive set of 60 nuclear power plant safety standards and supporting guides under the Agency's NUSS programme was first issued in the late 1970s. Although revised standards and guides have been published since, many guides are over ten years old. During 1995, a review of NUSS publications relating to nuclear power plant design, siting and operation was carried out and recommendations on revisions were made for consideration by the relevant advisory bodies.

Efforts continued to strengthen national nuclear safety regulatory systems by identifying good practices and structures and providing assistance with their implementation. Three meetings were held, each comprising up to seven regulatory bodies, to share experience obtained from measures used to assess the safety of existing nuclear power plants and to evaluate the effectiveness of regulations aimed at enhancing safety. The need to separate the responsibilities of regulators and licensees was recognized. It was also clear that a combination of prescriptive and performance based approaches to regulation needed to be used, and that performance based regulation is simplest when there are quantifiable objectives. The provision of useful information to the public from the regulator and licensee was likely to become increasingly necessary to ensure the continuing acceptance of the operation of nuclear power plants.

The concept of 'safety culture' is not new to the nuclear community and, during the past decade, has been increasingly used in connection with nuclear power plant safety. The Agency continued to promote this concept in 1995 by issuing guidance on how to interpret and assess safety culture, and offering services in the form of missions and seminars under the Assessment of Safety Culture in Organizations Team (ASCOT) scheme. On the basis of the considerable experience accumulated over the past two years through 22 ASCOT seminars in 19 countries, the ASCOT guidelines were revised, with the emphasis shifted to self-assessment by the respective organizations. ASCOT now offers essentially three options: support for self-assessment before and after the process; support for other Agency reviews; and standard or expanded topical seminars. In 1995, one ASCOT seminar was held in Romania in March. In addition, safety culture workshops were conducted in Bulgaria, the Czech Republic and Hungary.

Engineering Safety Issues of Nuclear Power Plants

Designers, professionals from operating organizations and experts with experience in seismic safety assessment are co-operating in co-ordinated research on seismic analysis and testing of nuclear power plants in order to enhance the seismic safety of WWER-440/213 and WWER-1000 type reactors. Within the scope of these long term studies, full scale dynamic testing of a reference plant was a key activity in 1995. The test was conducted for the Paks nuclear power plant in Hungary. Explosives were blasted at a safe distance from the plant and 150 experimental records were obtained at different locations (e.g. free field, reactor building foundation, floor levels and major reactor components). A similar experiment is envisaged for a 1000 MW WWER plant. Shorter term safety considerations for existing nuclear installations in relation to external hazards and site safety of new nuclear power plants are being reviewed within the scope of the Agency's Engineering Safety Review Services (ESRS). In 1995, 25 such reviews were conducted for both WWER and other types of nuclear facilities.

With regard to the safety aspects of nuclear power plant ageing, support continued to assist Member States in maintaining the required safety margins over the plant lifetime. This took the form of detailing guidelines and assisting in their application. A significant milestone was the organization of a meeting, in co-operation with the Comisión Nacional Energía Atómica of Argentina, on the effectiveness of methods for the detection and monitoring of age related degradation in nuclear power plants, held at San Carlos de Bariloche in October. The meeting was attended by specialists and managers from nuclear power

plants, regulatory and inspection agencies, and technical support and design organizations. In conjunction with this event, Research Co-ordination meetings were held on the management of ageing of concrete containment buildings and in-containment instrumentation and control cables. The Agency's studies on concrete containment ageing are proving to be complementary, rather than overlapping, with those carried out by the OECD/NEA.

There was significant progress during the year in the preparation of guidance material on fire safety at nuclear power plants. A report on the evaluation of fire hazard analyses for nuclear power plants was published. Guidance was also prepared on: the assessment of overall fire safety arrangements; fire safety during operation; the preparation of fire hazard analyses; and on how to treat internal fires in probabilistic safety assessments (PSAs). A fire safety review was conducted at the nuclear power plant at Karachi, Pakistan, and an interregional training course on fire safety at nuclear power plants was held in India.

Finally, a CRP was started on accident analysis methodology validation and verification to provide data for the development of guidance on severe accident analysis and accident management.

Operational Safety of Nuclear Power Plants

At a conference on advances in the operational safety of nuclear power plants, held in Vienna in September, discussions centred on: managing and regulating safe operation; safety performance and the lessons learned; improving operational safety through the use of PSA; and the enhancement of safety through the dissemination of experience. Consensus was reached that nuclear power plant operational safety efforts are not stagnant but are progressing, and that two categories of tools are widely utilized: risk analysis tools, such as PSA, and multiple feedback tools including peer reviews. Safety culture is well recognized as a prerequisite for the proper use of these tools. The conference underlined the fact that learning from experience and fostering teamwork offer an opportunity for the further improvement of operational safety.

A new computerized database, stored on CD-ROMs, was developed for the Advanced Incident Reporting System (AIRS). The database contains reports of safety significant events from operating nuclear power plants around the world. The full texts of these reports, with tables and illustrations, have now been incorporated and sophisticated query features permit searches and more effective dissemination of operational safety experience. The database will be distributed regularly in electronic form to participating Member States.

The Agency continued its comprehensive, three week on-site operational safety reviews by its Operational Safety Review Teams (OSARTs), concentrating on assessing management practices and operational programmes along with the performance of plant equipment and personnel. Work began on guidelines for plant self-assessment, a process that is gaining acceptance in Member States for the evaluation of operational safety performance and the improvement of operational practices.

Within the Assessment of Safety Significant Events Team (ASSET) service, two new additional options were offered: peer reviews of self-assessment of safety performance carried out by the plant, and topical analysis missions. Peer reviews of plant self-assessment can be carried out within five days, thus significantly reducing the duration and costs of missions. The topical analysis missions focused on events reflecting safety culture issues. This is intended to provide an international perspective on the root causes of problems connected with quality control, preventive maintenance, surveillance, feedback and corrective actions.

Research Reactor Safety

Of the research reactors currently operating around the world, more than 40% are over 30 years old. This has raised some concern and recently particular emphasis was given to the management of research reactor ageing. At an international seminar hosted by Germany in May in Hamburg, information was presented on in-service inspection techniques and methods for preventing or mitigating ageing effects, as well as on ageing phenomena in reactor components and materials. Questions of ageing related safety reviews and regulatory involvement were also addressed. While the general conclusion was that good progress has been made over recent years in the management of ageing, the methods and approaches used could be improved to ensure safety and efficiency. A CRP was started in 1995 on non-destructive testing techniques, in-service inspection and the detection of ageing indicators.

Missions to assess safety at research reactors — Integrated Safety Assessments of Research Reactors

(INSARR) — visited Bangladesh and Viet Nam. Since the inception of these services in 1972, a total of 123 missions have been conducted at operating research reactors in 37 Member States. An analysis of all the findings from these missions, including good safety practices and practices that required improvement, was initiated. Within the framework of technical co-operation activities, assistance was provided to Ghana and Egypt in the licensing review of the safety of new research reactor projects.

Nuclear Safety Assessment Practices

As a result of the complexity and multidisciplinary character of a probabilistic safety assessment (PSA), and because PSA has reached the point where it affects decisions on nuclear power plant design, regulation and licensing, there is international consensus that an intensive peer review by independent and experienced PSA practitioners should be an integral part of any such programme. Since the establishment in 1988 of the International Peer Review Service (IPERS) to make international expertise available for reviewing PSAs, 35 review missions have been carried out. In 1995, IPERS missions visited three nuclear power plants: Temelin in the Czech Republic, Bohunice in Slovakia and Cernavoda in Romania.

A review of the findings of past IPERS missions was completed during 1995. The most critical issues concern difficulties in acquiring, applying or adopting present PSA methodologies and techniques, and specific areas which need further investigation, such as the use of component data, the treatment of shared equipment and physical interaction dependencies and accident sequence quantification. IPERS can have a major influence on the quality of a PSA, thereby strengthening the credibility of the PSA in making safety related plant enhancements. On the basis of the practical experience acquired over five years, the IPERS guidelines were revised, with greater attention being given, in particular, to human reliability analyses.

Safety Approaches to Future Nuclear Power Plants

A technical document on the development of safety principles for the design of future nuclear power plants was completed. The principles are modelled according to information provided in the publications INSAG-3 and INSAG-5. For future plants, explicit consideration of severe accidents and minimization of the off-site effects of severe accidents in design are stressed. The broad international response to this document revealed that the information serves as an impetus for international harmonization of explicit safety objectives and principles for future nuclear power plants.

Safety Reassessment of Nuclear Power Plants

Activities related to the safety of nuclear power plants in the countries of eastern Europe and the former USSR continued. A major milestone was the final identification of safety issues for WWER-440/213, WWER-1000/320 and the third generation RBMKs, and publication of the findings. These reports present a consolidated list of deficiencies (safety issues) ranked according to their significance, and contain corrective measures to improve safety. The judgement of safety significance is based on an evaluation of the potential degradation of defence in depth. Plant specific operational safety issues were identified without ranking. A series of topical meetings was organized to review the status of unresolved generic safety issues.

For WWER-440/213 plants, the most important improvements relate to the physical separation of systems important to safety, in-service inspection and diagnostic systems and verification of the design of bubbler condenser containment. For WWER-1000/320 plants, the issues relate to steam generator integrity, the reliability of control rod insertion, and the integrity of the reactor coolant pressure boundary. A problem common to all WWER nuclear power plants is inadequate fire protection and fire fighting capability. Reviews of safety improvement programmes were organized at Kozloduy Units 5-6 (WWER-1000), Rovno Unit 4 (WWER-1000) and Dukovany (WWER-440/213).

For RBMK plants, the most relevant issues are: the safety culture as an underlying basis for operation; void reactivity associated with the loss of coolant from the channels of the control and protection system; independent and diverse reactor shutdown; demonstration of the applicability of the leak before break concept; volume and procedures for in-service inspection; and fire safety. In the identification and ranking of the RBMK issues, the results of an international project to investigate the safety of design solutions and the operation of nuclear power plants with RBMK reactors, funded by the EC and partially completed in early 1995, were taken into account.

Communication with the Public

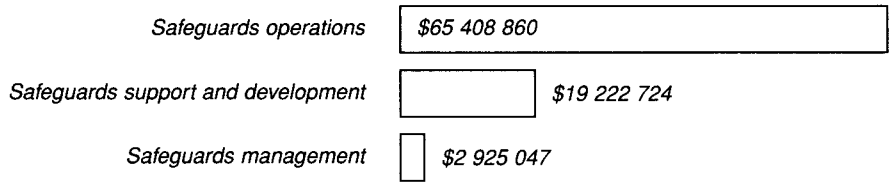
The International Nuclear Event Scale (INES) is a means for promptly and consistently communicating to the public the safety significance of events at nuclear power plants. It is also intended to facilitate common understanding of events by putting them into a proper perspective. Armenia, Croatia, Iceland and Kazakhstan joined the INES information system in 1995, so that 58 countries are now formally participating.

At their annual review of the system's operation, national officers of participating countries recommended the formal adoption of the INES scale for facilities other than nuclear reactors, and the preparation of information material, such as videos, to explain the scale to the general public. In 1995, a total of 62 events were communicated through the INES information system, of which 56 occurred in nuclear power plants and 6 in other facilities. None were at level 3 or higher. Efforts continued to simplify the INES rating procedure for events involving degradation of defence in depth.

SAFEGUARDS

Regular Budget expenditure: $87 556 631

Expenditure by subprogramme



Extrabudgetary programme resources utilized (not included in chart): $12 621 340

Note: *An amount of $5 859 479 for implementation of United Nations Security Council Resolution 687 on Iraq is not included in the extrabudgetary figure*

Safeguards Statement

In fulfilling the safeguards obligations of the Agency in 1995, the Secretariat did not find any indication that nuclear material which has been placed under safeguards was diverted for any military purpose or for purposes unknown, or that safeguarded facilities, equipment or non-nuclear material were misused. All the information available to the Agency supports the conclusion that the nuclear material and other items which were declared and placed under Agency safeguards remained in peaceful nuclear activities or were otherwise adequately accounted for.

The Agency is still unable to verify the correctness and completeness of the initial declaration of nuclear material made by the DPRK and is therefore still unable to conclude that there has been no diversion of nuclear material in the DPRK. The safeguards agreement between the DPRK and the Agency remains in force, and the Agency is continuing to implement safeguards measures in the DPRK under this agreement including the monitoring of the "freeze" on the DPRK's graphite-moderated reactors and related facilities, as requested by the United Nations Security Council and as foreseen in the "Agreed Framework" of October 1994 between the DPRK and the USA.

The Agency has been endeavouring to strengthen its capability for detecting undeclared nuclear material, facilities and activities. A number of measures designed to strengthen that capability have been implemented while others are either in the process of being implemented or are under development.

As of 31 December 1995, 207 safeguards agreements were in force with 125 States (and with Taiwan, China), compared with 200 agreements with 119 States (and with Taiwan, China) at the end of 1994.

Safeguards agreements pursuant to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) entered into force with Croatia in January, Myanmar in April, Zimbabwe in June and Belarus and Kazakhstan in August. A safeguards agreement pursuant to NPT and the Treaty of Tlatelolco entered into force with Bolivia in February. A safeguards agreement with Chile pursuant to the Treaty of Tlatelolco entered into force in April. A sui generis comprehensive safeguards agreement with Ukraine entered into force in January.

Sweden acceded to the safeguards agreement between the non-nuclear-weapon States of EURATOM, EURATOM and the Agency on 1 June, and Finland did so on 1 October.

The Government of Cuba informed the Agency that it had decided to terminate the construction of the research reactor which was to be supplied by the former USSR.

Consequently, the Agency's Board of Governors took note that the unilateral submission agreement with Cuba had terminated.

The Board of Governors approved a draft safeguards agreement with Barbados pursuant to NPT and the Treaty of Tlatelolco, and with Moldova and Ukraine pursuant to NPT. None of these agreements had entered into force at the end of 1995.

As of 31 December 1995, safeguards agreements were in force with 108 States pursuant to NPT. For 67 non-nuclear-weapon States party to NPT there is no safeguards agreement in force. As far as the Agency is aware, six of these States have significant nuclear activities. Out of these six, safeguards were being applied in four (Argentina, Chile, Colombia and Ukraine) pursuant to other comprehensive safeguards agreements, in one State pursuant to INFCIRC/66/Rev.2-type safeguards agreements (Algeria) and preparatory work for the application of safeguards is under way in the sixth State (Georgia).

NPT safeguards agreements are in force with all 11 signatories of the South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty); safeguards were applied in one of these States (Australia) pursuant to such an agreement.

Twenty-two of the 30 States party to the Treaty of Tlatelolco have concluded safeguards agreements with the Agency pursuant to that Treaty and at the end of 1995 safeguards agreements pursuant to the Treaty of Tlatelolco were in force with 19 States. Safeguards agreements pursuant to Additional Protocol I of the Treaty of Tlatelolco are in force with two States (Netherlands and the USA) with territories in the zone of application of the Treaty, and a similar agreement with a third such State (United Kingdom) has been approved by the Board of Governors, but has not yet entered into force. In June 1995, with a view to the early entry into force of safeguards agreements pursuant to NPT and the Treaty of Tlatelolco, the Board of Governors authorized the Secretariat to confirm, through an exchange of letters with the relevant States in the Latin America and Caribbean region, that:

— Comprehensive safeguards agreements concluded pursuant to the NPT satisfy the requirement under Article 13 of the Treaty of Tlatelolco for Contracting Parties to conclude safeguards agreements with the Agency;
— Comprehensive safeguards agreements concluded pursuant to the Treaty of Tlatelolco alone satisfy the requirement under Article III.1 of the NPT for non-nuclear-weapon States to conclude safeguards agreements with the Agency;
— The quadripartite safeguards agreement between Argentina, Brazil, the ABACC and the Agency satisfies the requirement of a State Party under either the Treaty of Tlatelolco or the NPT to conclude a comprehensive safeguards agreement.

At the request of the United Nations Security Council, the Agency has maintained a continuous inspector presence in the Nyongbyon area in the DPRK since May 1994. At the request of the Security Council, and as authorized by the Board of Governors, the Agency has since November 1994 monitored the freeze on the DPRK's graphite moderated reactors and related facilities as provided for in the "Agreed Framework" between the USA and the DPRK of 21 October 1994. The DPRK has enabled the Agency to implement specific safeguards measures and the safeguards activities, but has declined to accept other activities, such as the monitoring of nuclear liquid wastes at the reprocessing plant (Radiochemical Laboratory) and measurements of the plutonium content of spent fuel at the 5 MW(e) Experimental Nuclear Power Plant reactor. In addition to the safeguards activities carried out at facilities subject to the freeze (the Radiochemical Laboratory, Nuclear Fuel Rod Fabrication Plant, 5 MW(e) reactor, 50 MW(e) Nuclear Power Plant and the Taechon Nuclear Power Plant which is presently under construction), the Agency conducted inspections in 1995 at DPRK facilities not covered by the freeze (IRT Research Reactor, Critical Assembly, Nuclear Fuel Rod Storage and Sub-Critical Assembly). Other issues remain open.

The Agency's safeguards obligations in Iraq continued to be subsumed under the mandate assigned to the Agency by resolutions of the United Nations Security Council. Since August 1994, the Agency has maintained a continuous presence in Iraq to carry out monitoring and verification inspections to confirm that country's compliance with the relevant Security Council resolutions. In addition, the Agency conducted two inspections in 1995 to clarify specific matters relating to Iraq's past nuclear weapons programme.

In August 1995, the Agency received additional information on Iraq's former nuclear weapons programme in the form of new statements and numerous documents and materials transmitted to the Agency and the United Nations Special Commission by Iraq following the

departure to Jordan of Lieutenant General Hussein Kamel, the former Iraqi Minister of Industry and Military Industrialization. According to this additional information, a crash programme to produce a nuclear weapon had been launched shortly after Iraq's invasion of Kuwait (on 2 August 1990). This programme foresaw the extraction of the high enriched uranium (HEU) contained in the safeguarded research reactor fuel stored at the Iraqi nuclear research centre in Tuwaitha and its transformation into weapons-usable HEU metal. On 17 January 1991, the programme was effectively brought to a halt by the damage inflicted on Tuwaitha by air raids, which destroyed the building where the uranium extraction was planned before any processing of the fuel could occur. By this time, however, the chemical equipment needed to extract the uranium had been manufactured, installed and commissioned in a hot cell facility at Tuwaitha. The additional information is being examined for any new data which might affect the Agency's former assessment that Iraq's practical capability to manufacture nuclear weapons had been destroyed, removed or rendered harmless.

Safeguards Operations

During 1995, work on the verification of the nuclear material specified in the initial report pursuant to the safeguards agreement between Argentina, Brazil, the ABACC and the Agency and verification of facility design information was largely completed. This included verification activities at a gaseous diffusion enrichment facility in one of these States. Major installations in both States were also visited to verify the completeness and correctness of the initial report.

Following the entry into force of the comprehensive safeguards agreement with Chile pursuant to the Treaty of Tlatelolco, activities for the verification of the initial report provided pursuant to this agreement were carried out.

Considerable safeguards work was carried out in the newly independent states (NIS) of the former USSR, in particular:

— Initial inventory verifications pursuant to the sui generis safeguards agreement with Ukraine started in April.
— Verification of the initial inventory began pursuant to the NPT safeguards agreement with Belarus.
— Initial inventory verifications were undertaken pursuant to the NPT safeguards agreement with Kazakhstan. Special equipment for monitoring transfers of breeder fuel from the reactor, as well as surveillance systems, were put into operation.

Verification activities in 1995

	1993	1994	1995
Inspections performed	2 042	2 349	2 285
Person-days of inspection	8 153	9 152	10 167
Seals applied to nuclear material or safeguards equipment detached and subsequently verified (including seals applied jointly with a group of States)	20 755	21 746	23 877
Optical surveillance films reviewed	2 847	2 408	2 638
Video tapes reviewed	3 072	2 937	3 807
Inspection samples analysed	1 211	1 590	1 246
Analytical results reported	3 000	2 579	2 559

Development of a safeguards system for the CANDU 600 nuclear power complex in Romania proceeded according to schedule for Unit 1. The initial core loading was verified by the Agency. The reactor underwent hot performance tests in the last part of 1995, and the fuel handling systems were commissioned.

Some progress was made in the negotiation of Subsidiary Arrangements, one new and six revised General Parts of Subsidiary Arrangements (one new and five revised in 1994) and 16 facility attachments (7 new and 9 revised) (29 in 1994) entered into force.

A safeguards project between the Agency, China and the Russian Federation was agreed in September. The objective is to establish a basis for applying effective and efficient safeguards at the enrichment plant presently under construction at Han Zhong in China.

As a result of the decision announced by the President of the USA in September 1993 to submit to Agency safeguards excess nuclear material released from the US military programme, the Agency carried out monthly interim inspections at one site containing HEU and at one site containing plutonium. Safeguards activities in the USA increased considerably in 1995 as additional nuclear material was placed under safeguards. The initial verification was carried out on the newly received plutonium at one site in August. In April, a new storage facility was added by the USA to the eligible list and subsequently selected by the Agency for the implementation of safeguards. The verification of the initial inventory of plutonium at this site

began in early December. Further, following the President's decision on 1 March 1995 to permanently withdraw 200 tonnes of fissile material from the US nuclear stockpile, consultations were held to discuss the implementation of Agency safeguards on the material concerned.

Safeguards Support and Development

The Director General reported to the Board of Governors in March on proposed measures for strengthening the present safeguards system ("Programme 93+2"). The report discussed the interrelationship of the various measures and how their synergistic effect would increase the level of assurance that could be attained. Each measure was described in detail in terms of its cost or effort, technical and legal aspects (whether the Secretariat would implement the measures on the basis of existing legal authority or whether complementary authority would be sought). The Board endorsed the general direction of Programme 93+2 and reiterated its support for a safeguards system designed to provide credible assurance of the non-diversion of nuclear material from declared activities and of the absence of any undeclared nuclear activities. This support was also reflected in the strong endorsement in April at the NPT Review and Extension Conference of the work of the Agency to strengthen further the effectiveness of safeguards. As requested by the Board of Governors at its March meeting, the Secretariat submitted for the Board's consideration in June a comprehensive set of measures to strengthen and enhance the effectiveness of safeguards in two parts. Part 1 consisted of those measures which could, in the Secretariat's view, be implemented under existing legal authority and which it would be practical and useful to implement at an early date. Part 2 consisted of those measures which the Secretariat proposed for implementation on the basis of complementary authority. The Board accepted the Director General's plan to implement at an early date the measures described in Part 1. The General Conference endorsed the actions taken by the Board in March and June.

Following the meeting of the Board in June, a detailed implementation plan was developed. This provided the basis for a letter sent in November to States party to comprehensive safeguards agreements describing the actions the Secretariat had identified as being necessary to proceed further. The letter indicated that the Secretariat would undertake implementation of Part 1 measures, starting in 1996, as broadly and extensively as possible, subject to operational and budgetary constraints. Some measures are currently being implemented.

A draft discussion paper containing additional details on the Part 2 measures to be implemented under complementary authority was discussed by the Board of Governors during its meeting in December. The paper contained a draft protocol to comprehensive safeguards agreements that the Secretariat is proposing as the means by which States can provide the Agency with the authority to implement the Part 2 measures. The Secretariat was asked to consider all the comments made by Member States when finalizing and fine-tuning its proposals for Part 2 of Programme 93+2 for Board action.

The Safeguards Analytical Laboratory (SAL) and the Network of Analytical Laboratories (NWAL) performed 1752 measurements for calibration and quality control on non-destructive analysis (NDA) techniques, for certification of secondary reference samples, for maintenance and improvement of off-site destructive analysis (DA) and for testing procedures for on-site DA. In addition, 2931 measurements were performed by SAL and the NWAL for the routine quality control of the analysis of inspection samples. SAL also assisted in the measurement of samples taken in Iraq during inspections carried out pursuant to United Nations Security Council resolutions. A total of 70 analytical results were reported by SAL on environmental type samples taken during routine or ad hoc inspections as well as field trials under Programme 93+2. The median times required to complete verification by off-site DA were 52 days for uranium, 59 days for plutonium and 59 days for spent fuel samples.

The construction of a clean laboratory for safeguards analytical work was completed. Procedures for measuring environmental samples in the laboratory were developed and tested. The primary isotopic mixes required for the preparation of reference materials for performance evaluation of the clean laboratory and of network laboratories were also completed. Samples of these reference materials were distributed to selected laboratories.

As part of Programme 93+2, environmental sampling field trials were conducted. In support of the decision to proceed with the implementation of measures contained in Part 1 of Programme 93+2, guidelines were developed for the planning, collection and analysis of swipe samples at enrichment plants and hot cell facilities. A review was carried out in December of the experience gained in the course of the field trials and there was discussion of the establishment of an effective and efficient analytical services network.

At its meeting in February 1993, the Board of Governors endorsed the establishment of a reporting scheme for nuclear material and specified equipment and non-nuclear material as a means of strengthening the Agency's safeguards system. The Board further expressed the hope that subscription to the scheme, which will be voluntary in nature, would become universal. Information received by the reporting scheme is used on a routine basis as part of the more systematic analysis by the Agency of information about nuclear activities. To date, 52 Governments and the European Union have indicated that they intend to participate in the reporting scheme, with 35 of these States and the European Union having already submitted information.

Activities in 1995 in the New Partnership Approach (NPA) with EURATOM included a review of Agency and EURATOM equipment needs for 1995 and 1996 encompassing the replacement of obsolete equipment and verification needs at new facilities. Common training courses for Agency and EURATOM inspectors were organized. The sharing of analytical capabilities using a mobile mass spectrometer for inspections at low enriched uranium (LEU) fuel fabrication and enrichment plants was initiated, thus reducing the cost of transporting and analysing samples at each organization's analytical laboratory.

As part of the development of Programme 93+2, and with the co-operation of a Member State, a six month field trial was initiated to demonstrate a remote monitoring system at a storage vault for MOX fuel. The system includes self-contained digital video cameras, and features the authentication and encryption of the surveillance data, as well as remotely verifiable seals. Sophisticated power monitoring and control, front end scene change detection and backup scene and data storage are integral parts of the digital camera. Surveillance images and data are transmitted to the Agency by means of low cost, ultra-small aperture satellite communications. Inspector review is carried out using a computer based review station. The results of the field trial will be evaluated as part of an overall study of remote monitoring systems.

Actions to improve the performance of modular integrated video surveillance systems were implemented, including: modifications for increased immunity to mains power anomalies and electromagnetic interference; training for inspectors in troubleshooting, problem diagnosis and corrective actions; improvements to facility power sources; improvements in the availability and distribution of spare components; and improvements in performance monitoring. As a result, the mean time between failure of these systems improved from 30 months in 1994 to 50 months in 1995.

The extrabudgetary Member State support programmes continued to provide major contributions to the research and development and safeguards implementation support activities. Some 250 projects addressing safeguards needs identified by the Agency were under way, and about 60, were completed. During the year, bilateral meetings were held to review the status and activities of all the programmes.

SECURITY OF MATERIAL

Extrabudgetary programme resources utilized: $478 824

This is a new programme which was established in 1995 with the aim of ensuring the security of nuclear material and other radioactive sources. With support from Member States, the Secretariat established an illicit trafficking database designed to provide a reliable source of information to States and the public on all incidents where illegal movement of such materials has been reported. At the end of 1995, 163 incidents were contained in the database.

In May, the Agency held a meeting of representatives from 16 countries to consider the provision to the Agency of information from governments on illicit trafficking and Agency reports to governments. States were invited to indicate their interest in participating in a programme on information sharing and, by the end of 1995, 25 had responded positively.

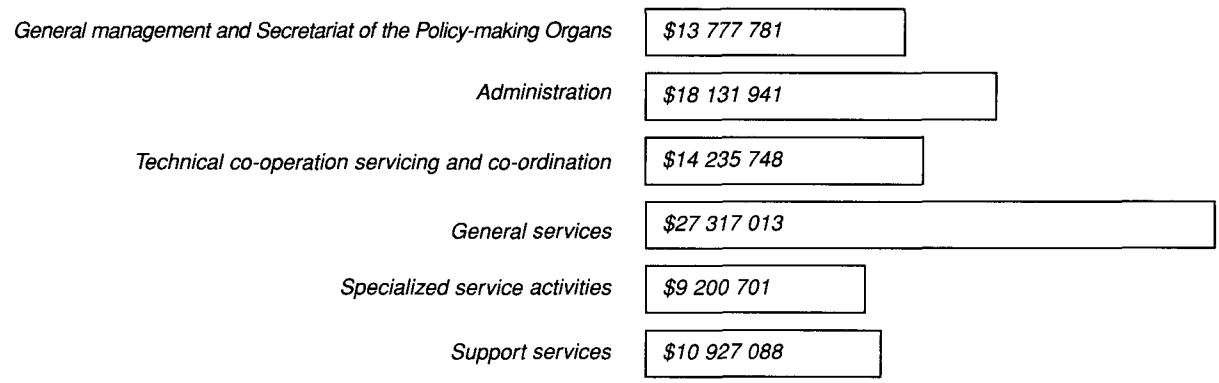
In June, the Agency convened a Technical Committee meeting in Vienna to consider actions to be taken to combat the illicit movement of materials. The meeting included representatives from 20 Member States plus EUROPOL and the World Customs Organization. Recommendations were made to the Agency related to information sharing, co-ordination of activities, detection of materials at borders, utilization of the Agency's illicit trafficking database and notification of incidents.

Another meeting, in Vienna in September, of international organizations (the United Nations, INTERPOL, World Customs Organization, EURATOM, EUROPOL, IMO and ICAO) examined the cross-border movement of radioactive materials, including nuclear materials. In 1995, the Agency convened three meetings to address various aspects of guidance needed by States in strengthening their programmes concerned with the illicit movement of radioactive sources.

DIRECTION AND SUPPORT

Regular Budget expenditure: $93 590 272

Expenditure by subprogramme



Extrabudgetary programme resources utilized (not included in chart): $2 746 954
(this includes a sum of $1 297 215 for AGRIS)

Administration

Personnel

The Director General approved an action plan designed to improve the status and representation of women in the Secretariat. A statement was delivered at the United Nations Fourth World Conference on Women, held in Beijing, outlining the Agency's commitment to the advancement of women. The percentage of women at the end of 1995 among the Professional staff was 17%. Developing countries provided 32.1% of the staff subject to geographical distribution.

A comprehensive programme was implemented under which approximately 600 staff members received training to improve their job related skills, with particular emphasis on communication and managerial skills. Four Junior Professional Officers from developing countries received on-the-job training in administrative and scientific/technical areas in the Secretariat designed to enable them to apply for regular positions or use the experience gained in their home countries.

Studies were initiated on the costing and effective use of human resources in the Secretariat. Some of the studies provided a basis for determining the human resources requirements for the 1997–1998 budget proposals. Others will focus on the impact of office automation and the use of temporary assistance.

Legal

The Standing Committee on Liability for Nuclear Damage continued its examination of the revision of the Vienna Convention and elaboration of an instrument for supplementary funding. The Committee adopted, with the exception of liability amounts, and reservations to some provisions, a full set of draft texts for an amending protocol to the Vienna Convention. The draft amendments cover important areas where a need for improvement was recognized, such as: the geographical scope of

the convention; its application to military installations; the concept of nuclear damage; increase of operator liability and provision for an Installation State tier; and extended time limits for the submission of claims.

On the question of supplementary funding, two basic approaches were under consideration. One provides for a convention that will operate within the legal framework of the Vienna and Paris Conventions and cover both transboundary and domestic nuclear damage. The other approach envisages a free standing convention which is open to adherence irrespective of participation in the Vienna or Paris Conventions and is dedicated to transboundary nuclear damage only. As there was no consensus on either approach, efforts were made to reconcile them into a single draft. Thus, there would be a free standing instrument whose system is supplementary to national legislation that (a) implements the Vienna or Paris Conventions, or (b) would be consistent with the requirements set out in an annex to the draft convention which restate the major liability norms of the two conventions. A single supplementary fund would cover domestic and transboundary damage on the basis of a specified ratio. Contributions by States parties to the fund would be based on a formula which takes into account their nuclear capacity and their rate of assessment to the United Nations regular budget. The position of non-nuclear States was also taken into account. A convergence of views appeard to be possible on the form and many provisions of the new draft. Also, in informal consultations, elements of the structure of the supplementary fund were identified as a basis for further work.

On the basis of the progress made, the Standing Committee at its 13th session concluded that it seemed feasible to prepare texts for the amending protocol to the Vienna Convention, as well as a convention on supplementary funding to be submitted at a diplomatic conference. The goal of the Committee was to complete its preparatory work before the end of 1996.

Technical Co-operation Servicing and Co-ordination

Efforts in the technical co-operation area were focused on consolidating recent experience and initiatives to strengthen the efficiency and effectiveness of the programme. Five key activities now provide a more strategic orientation to co-operation with Member States:

— Model projects
— Country planning frameworks
— Sectoral planning
— Expanded co-ordination with other multilateral and bilateral organizations
— Streamlining of management practices and procedures.

These initiatives resulted from discussions in the Board of Governors and as an outcome of the Policy Review Seminar in September 1994. A new and unifying goal was for the Agency to establish a 'partnership in development' with Member States. This goal has required a significant emphasis on planning and assessment, which dominated technical co-operation activities during the year.

Over the last two years, the Agency has gained valuable experience in transferring the benefits of nuclear technologies to end users through 'model' projects. The implementation of 11 new projects of this type began in 1995, bringing the total number to 23. One lesson learned is the need to identify clear objectives and develop verifiable indicators of project performance. Such indicators have now been established for each model project and project objectives have been reviewed. The introduction of performance indicators in most technical co-operation projects proposed for the 1997–1998 programme is an important step toward a systematic evaluation methodology, and a clear example of how model projects have already influenced overall project design.

Project management was the focus of attention in 1995 as a new approach for the model projects on upgrading radiation protection and waste safety infrastructure was established. A review of the status of these two model projects indicated that a more effective system of accountability and responsibility would be necessary to help Member States achieve the minimum requirements of the Agency's Basic Safety Standards by the end of the century. Two new management elements were singled out as being essential to making the new system function effectively: a clearly identifiable focal point for the entire effort and a firm commitment to time limited objectives.

The year provided an opportunity to institute a major change in programming that will ensure that the Agency's technical co-operation activities are linked directly to a country's sectoral or national development objectives. Twenty-seven Country Programme Frameworks (CPFs) were initiated. The strategic importance of the CPF is that it forms an agreement between the Agency and governments to concentrate technical co-operation activities on a few priority areas that can produce significant national impacts. The CPF mechanism focuses on identifying key

activities or the opportunities for model projects that would form the centrepiece for national efforts to utilize nuclear technologies.

Efforts were increased to systematically plan technical activities. The concept of thematic or sectoral planning is being elaborated in radioimmunoassay activities, which have achieved significant results in most of the countries evaluated in 1995 owing to well defined objectives, sound design and effective integration of components, such as training, experts and equipment. Work also began on identifying capabilities in Member States for certain nuclear techniques, such as nuclear instrumentation. This effort is tied to both the CPF process and resource mobilization efforts. The feasibility of a specific technique, along with the capacity of a particular country to use the technology, are important benchmarks for planning technical co-operation activities with Member States.

An important development during the year was the effort to develop regional approaches that apply model project criteria and objectives. This task was aided by the results of an external report on possible future directions for regional programming which was released in December 1995. Several proposals emphasizing 'bottom up' solutions and technical co-operation among developing countries for animal disease and insect and pest control, animal production and isotope hydrology are being reviewed and assessed against model project criteria for the 1997–1998 technical co-operation programme. One project in rinderpest eradication would consolidate the various national and regional initiatives under a single global project to improve co-ordination and effectiveness.

In connection with the issue of predictable and assured financing for technical co-operation activities, and as a result of concern over the lack of growth of resources available to finance the increasing demand for these activities, the Board of Governors encouraged the Agency to undertake a more structured approach to the mobilization of additional resources. It was suggested, in particular, that non-traditional sources, such as the bilateral development organizations and multilateral financial institutions, could be approached. Experience in 1995 with model projects showed that supplemental financing can be obtained if projects are of sufficiently high quality, and if beneficiary countries are also prepared to take action to gain funding. With these lessons in mind, closer links were promoted between the programme and project objectives of the Agency and those of bilateral development organizations.

Increased emphasis on project completion resulted in over 300 closures, bringing the total for the last two years to almost 600 projects — a significant reduction in routine work for project and technical officers. Communications and the flow of information were also enhanced by access to the Internet service.

Operationally, new records were established in 1995 for financial implementation and performance. For the second year, the amount of unobligated resources carried forward between years was significantly reduced — by some 35% — as a result of a high implementation rate of 75%. The policy of maintaining a higher level of programme commitments than of resources ('over-programming') was largely responsible for the overall increase in implementation, but the higher rate for model projects (84.3%) reflects the greater 'implementability' of projects that are more realistically planned and budgeted, as well as the impact of strengthened project management and procedural streamlining. In every area of project implementation, delivery was higher than in previous years.

Specialized Service Activities

Public Information

Public information efforts in 1995 were marked by an initiative on the role of Agency safeguards in the context of the NPT Review and Extension Conference. A new film entitled *International Safeguards* was produced (in addition to printed material) and shown at the Conference in New York. Other film related projects included a lead role in producing a film for visitors to the Vienna International Centre, the shooting of sequences for a new Agency corporate video and market research on the feasibility of providing short video features on Agency related topics to television outlets.

The Agency embarked on a major new initiative to meet electronic information needs through the Internet, where a range of user friendly services were developed and offered on the Agency's *World Atom* Web site.

The series of Public Information Seminars continued, with events in Brazil, Cuba, Japan, South Africa and Viet Nam.

International Nuclear Information System

Armenia, Estonia, Kazakhstan, Myanmar, Tunisia and Uzbekistan joined the International Nuclear Information

System (INIS) during 1995. The number of participating Member States thereby rose to 94 (together with 17 international organizations). A total of 79 021 records of published literature were added to the database and announced in the abstracting journal *Atomindex*, bringing the total number of records stored to 1 856 206. A new version of the FIBRE software was put into use for the preparation of input for the database.

The INIS Clearinghouse microfilmed the full text of 4455 non-conventional literature documents (such as reports, conference proceedings, dissertations and laws) containing 15 652 cited references (367 575 pages). By the end of 1995, the collection of non-conventional literature on microfiche was approximately 305 000 documents.

The Clearinghouse also completed a pilot imaging project to demonstrate the feasibility of electronic storage of non-conventional literature on CD-ROM. During the study, the Clearinghouse produced six CD-ROMs containing 51 416 pages of non-conventional literature and related bibliographic data, and retrieval software.

The 23rd Consultative Meeting of INIS Liaison Officers was held in Vienna in May. The officers made recommendations on: partnerships with primary and secondary publishers designed to obtain bibliographic records more cost effectively; the phasing out of the printed *Atomindex*; delivery of the full text of non-conventional literature in electronic form; improvements in the timeliness of the database; and the production of the INIS database on CD-ROM.

In May, INIS celebrated its 25th anniversary, recalling the key role that it has played in providing access to nuclear information to support activities worldwide.

Support Services

Library

Work at the Vienna International Centre Library on the second phase of installation of *VICLION*, the integrated library automation system, was completed with the installation and startup of the acquisitions and serials control modules. This concluded the process, begun three years ago, of moving the Library's files from the mainframe system to a distributed, networked system.

Data Processing

In 1995, central computer services completed a four year effort to implement a standard technology architecture to support the Agency's decentralized computer environment. Over 1400 PCs have been converted since 1991 to a standard Agency-wide hardware and software configuration. The speed capability of most of the Agency's local area networks (LANs) was upgraded from 4 to 16 Mbits per second and a new, advanced technology operating system, *Windows NT*, was installed on most of the LAN server computers to provide improved services and more powerful capabilities.

The Agency's initial Internet information service technology was expanded and a more secure computing environment for the Agency's services was provided. Standards and guidelines for World Wide Web developers were released and a sample database for official records of the Board of Governors was created.

A six month pilot project was carried out with the purpose of evaluating the technical, economic and organizational aspects of enhanced electronic communication of information and documentation between the Agency and Member States.

CD-ROM production systems and services were initiated in support of the Advanced Incident Reporting System (AIRS) and the activities of the United Nations Security Council 687 Action Team for Iraq.

Publishing and Printing

Over 170 books, reports, journal issues or booklets were published in English during 1995. In addition, there were 11 publications in French, 8 in Russian and 6 in Spanish. Of particular note were:

— *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources*
— *Nuclear Techniques in Soil–Plant Studies for Sustainable Agriculture and Environmental Preservation*
— *Energy from Inertial Fusion*
— *The IAEA Yearbook 1995*

During the year, facilities for direct electronic transfer of material to digital printing were established and put into operation.

SUMMARY AGENCY BUDGETARY AND STAFFING DATA

Budget

For 1995, the General Conference appropriated an amount of about $212 million for the Agency's Regular Budget on the basis of an exchange rate of 12.70 Austrian Schillings to one United States dollar, of which $206 million was related to Agency programmes. The latter amount was adjusted to $251 million to account for the average United Nations exchange rate (10.03 Austrian Schillings to one US dollar) actually experienced during the year.

The Regular Budget for 1995, at an exchange rate of 10.03 Austrian Schillings to one US dollar, amounted to some $258.5 million, of which $248 million was to be financed from contributions by Member States on the basis of the 1995 scale of assessment, $7.5 million from income from reimbursable work for others and $3 million from other miscellaneous income.

The actual expenditures for the Agency's Regular Budget in 1995 amounted to some $253 million, of which $245 million was related to the Agency's programmes. The unused budget from the Agency's programmes amounted to $5.8 million, while the total unused budget was $5.3 million when account was taken of reimbursable work for others. Expenditures for programme activities deferred from 1994 amounted to some $10 million from a total of $13 million related to the Agency's Regular Budget.

The target for voluntary contributions to the Technical Co-operation Fund for 1995 was established at $61.5 million, of which $47.7 million was pledged by Member States.

A total of about $57.9 million in extrabudgetary funds was provided by Member States, the United Nations, other international organizations and other sources during 1995. Of this amount, $14 million was in support of safeguards, $9.1 million was for technical co-operation projects, $2.6 million for projects in food and agriculture, $3.8 million for nuclear safety and $5.6 million for implementation of United Nations Security Council Resolution 687 on Iraq. An amount of some $17.2 million (supplemented by the Agency's contribution of $1.7 million) was available for the ICTP, and $1.5 million (supplemented by the Agency's contribution of $3.3 million) for IAEA-MEL. The remaining $4.1 million was in support of various other projects implemented by the Agency.

The sum of $0.75 million was provided in 1995 by Member States for technical co-operation activities as funds-in-trust. Furthermore, a total of $1.2 million was administered on behalf of research institutions and $2.4 million for the International Thermonuclear Experimental Reactor (ITER).

Staffing

At the end of 1995, the number of staff members in the Secretariat was 2295 — 890 in the Professional and higher categories and 1405 in the General Service category. These figures represent 1673 regular, 214 temporary assistance and 308 extrabudgetary staff, as well as 76 cost free experts and 24 consultants. Among the 629 staff members in posts subject to geographical distribution, 90 nationalities were represented.

THE BOARD OF GOVERNORS AND THE GENERAL CONFERENCE

Bosnia and Herzegovina became a member of the Agency by depositing an instrument of acceptance of the Agency's Statute. The application of Georgia for membership was approved by the General Conference, but the instrument of acceptance has not yet been deposited with the Government of the USA in accordance with the Agency's Statute. The application of Moldova was recommended by the Board of Governors and will be submitted to the General Conference in 1996.

A new scheduling of Board meetings was approved in February 1994. This schedule, and a redistribution of agenda items between the different sessions so that specific sessions would focus on particular issues, were successfully put into operation in 1995.

There were some positive developments in the discussions in both the Board of Governors and the General Conference on the revision of Article VI of the Agency's Statute as a whole. After many years a formal proposal was submitted for the consideration of the Board and the General Conference and, although it was not approved, it helped to focus the debate. At the request of the General Conference, the Board re-established a successor informal open-ended consultative group on the issue and this is expected to submit recommendations to the General Conference in 1996.

Also, following an extensive debate, a decision was taken to set up an informal open-ended consultative group to consider the criteria for designating members to the Board of Governors.

The General Conference requested the Director General to study all of the implications of a proposal which was before it at its 39th session relating to the classification of Member States into the eight area groups specified in the Statute. The Director General was requested to submit a report on this matter for the consideration of the Board of Governors, which will subsequently report to the General Conference.

The long standing issues of the financing of technical assistance and of safeguards were considered in detail. Two separate working groups established by the Board at the request of the 1994 General Conference decided, in view of the interdependent nature of the tasks, to formulate a compromise. Subsequently, a package merging the two issues was adopted by the Board and later by the General Conference. Since the compromise did not resolve all related issues, it was agreed that a further review of the financing of safeguards would be undertaken before the year 2000, while other unresolved issues regarding the financing of technical assistance may be discussed in the Board in the near future.

ANNEX

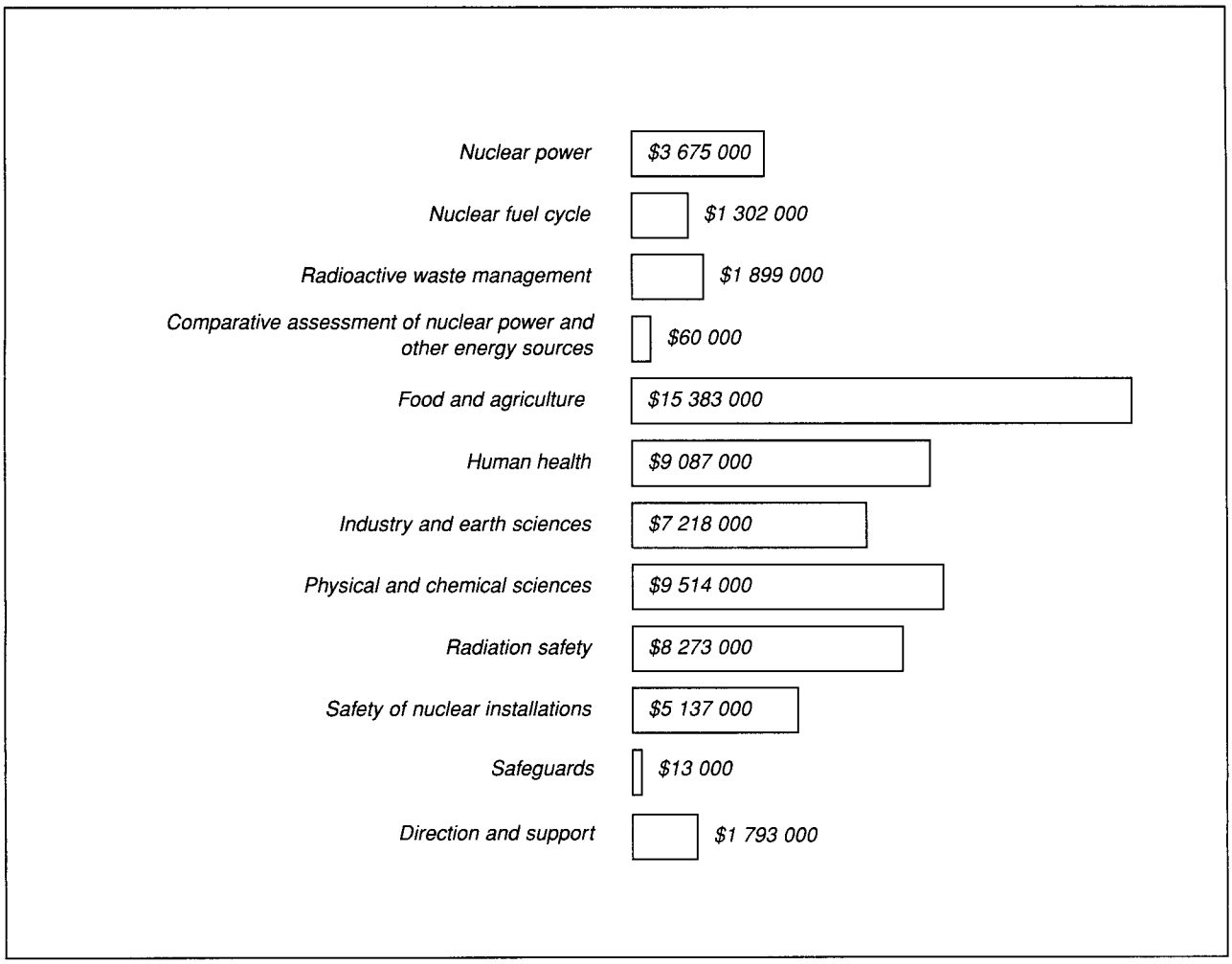
Summary of allocation and utilization of Agency regular budget resources by programme in 1995

Programme	Budget GC(XXXVIII)/5 (at AS 12.70)[a] (1)	Adjusted budget (at AS 10.03)[a] (2)	Total expenditure (3)	Unused budget (2)–(3) (4)
Nuclear Power	5 011 000	6 084 900	5 757 427	327 473
Nuclear Fuel Cycle	2 595 000	3 122 200	2 957 904	164 296
Radioactive Waste Management	6 173 000	7 495 200	7 800 346	(305 146)
Comparative Assessment of Nuclear Power and Other Energy Sources	2 016 000	2 433 600	1 964 351	469 249
Subtotal	15 795 000	19 135 900	18 480 028	655 872
Food and Agriculture	10 098 000	12 154 000	12 197 167	(43 167)
Human Health	5 683 000	6 826 400	7 056 738	(230 338)
Industry and Earth Sciences	3 400 000	4 088 500	3 875 955	212 545
Physical and Chemical Sciences	8 312 000	9 718 300	9 385 568	332 732
Subtotal	27 493 000	32 787 200	32 515 428	271 772
Radiation Safety	4 400 000	5 354 500	5 043 077	311 423
Safety of Nuclear Installations	6 693 000	8 183 400	8 201 441	(18 041)
Subtotal	11 093 000	13 537 900	13 244 518	293 382
Safeguards Operations	56 033 000	68 010 200	65 408 860	2 601 340
Safeguards Support and Development	14 104 000	17 357 800	19 222 724	(1 864 924)
Safeguards Management				
Planning, Direction, Co-ordination	0	0	229 925	(229 925)
and Control[b]	[323 000]	[399 000]	[440 239]	[(41 239)]
Effectiveness Evaluation	998 000	1 238 000	1 228 049	9 951
Programme and Resources	1 287 000	1 598 000	1 467 073	130 927
Subtotal	72 422 000	88 204 000	87 556 631	647 369
General Management and Secretariat of the Policy-making Organs	11 933 000	14 685 000	13 777 781	907 219
Administration	15 683 000	19 264 000	18 131 941	1 132 059
Technical Co-operation Servicing and Co-ordination	11 795 000	14 589 000	14 235 748	353 252
General Services	22 184 000	27 880 000	27 317 013	562 987
Specialized Service Activities	7 937 000	9 750 000	9 200 701	549 299
Support Services	9 182 000	11 326 000	10 927 088	398 912
Subtotal	78 714 000	97 494 000	93 590 272	3 903 728
Total Agency programmes	**205 517 000**	**251 159 000**	**245 386 877**	**5 772 123**

[a] AS: Austrian Schillings.

[b] Included in General Management and Secretariat of the Policy-making Organs.

Technical co-operation disbursements by Agency programme in 1995



Agency topical meetings in 1995 to review the status of generic safety issues

Reactor type	Topic
WWER-440/230	Reactor pressure vessel integrity. Confinement improvement options. Confinement leak rate measurements.
WWER-1000	Control rod insertion reliability. Steam generator integrity
RBMK	Evaluation of void and other reactivity effects. Shutdown system modernization. Leak before break applications.

International Peer Review Service (IPERS) missions in 1995

Review type	Country	Nuclear power plant
Main review	Slovakia	Bohunice
Main review	Czech Republic	Temelin
Main review	Romania	Cernavoda
Pre-review	Ukraine	Zaporozhe

Assessment of Safety Significant Events Team (ASSET) services in 1995

Type	Country	Location/nuclear power plant
F	Hungary	Paks
R	Ukraine	South Ukraine
S	Ukraine	Khmelnitsky-1
S	Hungary	Budapest
S	Romania	Bucharest
S	Russian Federation	Kursk
S	Russian Federation	Kursk
S	Bulgaria	Sofia
S	China	Beijing
S	Czech Republic	Prague
S	Sweden	Forsmark
S	Ukraine	Chernobyl
S	USA	Argonne
T	Russian Federation	Kursk

Type F: Follow-up mission; **Type R:** Review mission; **Type S:** Seminar; **Type T:** Analysis mission.

Operational Safety Review Team (OSART) missions in 1995

Type	Country	Nuclear power plant	Plant type
E	Bulgaria	Kozloduy-5/6	WWER-1000/320
E	Czech Republic	Dukovany	WWER-440/213
E	Ukraine	Rovenskaya-3	WER-1000/320
O	France	Cattenom	PWR-1360 MW
O	France	Flamanville	PWR-1382 MW
O	Japan	Hamaoka-3/4	BWR-1100 MW
O	Lithuania	Ignalina	RBMK-1500 MW
O	Switzerland	Beznau	PWR-364 MW
O	United Kingdom	Hunterston B	AGR-620 MW
O	Ukraine	Khmelnitsky-1	WWER-1000/320
S	Russian Federation	Novovoronezh-3/4	WWER-440/230
T	Ukraine	Zaporozhe	WWER-1000/320

Type E: Expert mission to review upgrade programme; **Type O:** OSART mission; **Type S:** Safety review mission; **Type T:** Technical exchange mission.

Engineering Safety Review Services (ESRS) related to site and external hazards

Country	Site/Plant	Service
Armenia	Medzamor WWER-440/230	(1) Review of tectonic stability and volcanic hazard. (2) Review of design basis seismic parameters.
Bulgaria	Belene WWER-1000 Kozloduy, Unit 5 WWER-1000	(1) Review of design basis seismic parameters. (2) Review of seismic PSA.
Czech Republic	Central interim spent fuel storage facility	(1) Review of site survey results. (2) Review of geological characteristics of the Skalka site.
Hungary	Paks WWER-440/213	(1) Review of automatic seismic trip system. (2) Review of tectonic stability. (3) Review of design basis seismic parameters. (4) Follow-up review of desgin basis seismic parameters.
Indonesia	Muria	(1) Review of site safety. (2) Review of tectonic stability and volcanic hazard. (3) Follow-up review of tectonic stability and volcanic hazard.
Iran, Islamic Rep. of	Bushehr WWER	Review of tectonic stability and design basis seismic parameters.
Kazakhstan	Alatau research reactor, WWR 10 MW	Review of tectonic stability and seismic capacity.
Korea, Rep. of	Generic	Regional workshop on seismic hazard methodology.
Morocco	Sidi Boulbra	Review of design basis seismic parameters.
Pakistan	Chashma PWR 300 MW (Chinese design)	(1) Review of seismic design. (2) Follow-up review of seismic design (in Shanghai).
Russian Federation	WWER generic	Workshop on seismic assessment and upgrading of WWER type nuclear power plants.
Slovakia	Mochovce WWER-440/213	Preparation of terms of reference for seismic assessment and upgrading.
Thailand	Not yet defined	Review (with two follow-up missions) of terms of reference for site survey and evaluation.
Uzbekistan	Ulughbek research reactor WWR 10 MW	Review of tectonic stability and seismic capacity.

Number of States having significant nuclear activities at the end of 1993, 1994 and 1995

	Number of States		
	1993	1994	1995
States with safeguards applied under NPT or NPT/Tlatelolco agreements	47[a]	49[a]	53[a,b]
States with safeguards applied under Tlatelolco agreements	1	1	2
States with safeguards applied pursuant to other comprehensive safeguards agreements	0	2	3
States with safeguards applied under INFCIRC/66/Rev.2-type agreements[c]	8	6	5
Nuclear-weapon States with safeguards applied under voluntary-offer agreements	5	5	5
States without any safeguards agreement in force	8	5	1
Total number of States with significant nuclear activities[d]	69	68	69

[a] This excludes Iraq, where safeguards activities in 1995 continued to be subsumed under activities carried out pursuant to United Nations Security Council Resolution 687.

[b] This includes the Syrian Arab Republic, where no safeguards inspections were carried out, because the nuclear material subject to safeguards was only supplied to the Syrian Arab Republic in December 1995, and Uzbekistan, where preparatory work for the application of safeguards was carried out in 1995.

[c] Some States with INFCIRC/66/Rev.2-type agreements under which the application of safeguards has not yet been suspended, although NPT or other comprehensive safeguards agreements have entered into force, are listed under NPT agreements only. Nuclear-weapon States with INFCIRC/66/Rev.2-type agreements in force are not included. Safeguards are also applied to nuclear installations in Taiwan, China.

[d] According to information available to the Agency for the year in question.

Situation on 31 December 1995 with respect to the conclusion of safeguards agreements between the Agency and non-nuclear-weapon States in connection with NPT

Non-nuclear-weapon States which have signed, ratified, acceded to or succeeded to NPT[a] (1)	Date of ratification, accession or succession[a] (2)	Safeguards agreement with the Agency (3)	INFCIRC (4)
Afghanistan	4 February 1970	In force: 20 February 1978	257
Albania[b]	12 September 1990		
Algeria	12 January 1995		
Antigua and Barbuda[c]	1 November 1981	Signed: 1 February 1990	
Argentina[d]	10 February 1995		
Armenia	15 July 1993	In force: 5 May 1994	455
Australia	23 January 1973	In force: 10 July 1974	217
Austria	27 June 1969	In force: 23 July 1972	156
Azerbaijan	22 September 1992		
Bahamas	10 July 1973		
Bahrain	3 November 1988		
Bangladesh	27 September 1979	In force: 11 June 1982	301
Barbados[c]	21 February 1980	Approved by the Board, June 1995	
Belarus	22 July 1993	In force: 2 August 1995	495
Belgium	2 May 1975	In force: 21 February 1977	193
Belize	9 August 1985	Signed: 13 August 1992	
Benin	31 October 1972		
Bhutan	23 May 1985	In force: 24 October 1989	371
Bolivia[c]	26 May 1970	In force: 6 February 1995	465
Bosnia and Herzegovina	15 August 1994		
Botswana	28 April 1969		
Brunei Darussalam	25 March 1985	In force: 4 November 1987	365
Bulgaria	5 September 1969	In force: 29 February 1972	178
Burkina Faso	3 March 1970		
Burundi	19 March 1971		
Cambodia	2 June 1972		
Cameroon	8 January 1969	Signed: 21 May 1992	
Canada	8 January 1969	In force: 21 February 1972	164
Cape Verde	24 October 1979		
Central African Republic	25 October 1970		
Chad	10 March 1971		
Chile[e]	25 May 1995		
Colombia[f]	8 April 1986		
Comoros	4 October 1995		
Congo	23 October 1978		
Costa Rica[c]	3 March 1970	In force: 22 November 1979	278
Côte d'Ivoire	6 March 1973	In force: 8 September 1983	309
Croatia	29 June 1992	In force: 19 January 1995	463
Cyprus	10 February 1970	In force: 26 January 1973	189
Czech Republic[g]	1 January 1993	In force: 3 March 1972	173

Table (cont.)

Non-nuclear-weapon States which have signed, ratified, acceded to or succeeded to NPT[a] (1)	Date of ratification, accession or succession[a] (2)	Safeguards agreement with the Agency (3)	INFCIRC (4)
Democratic People's Republic of Korea	12 December 1985	In force: 10 April 1992	403
Denmark[h]	3 January 1969	In force: 21 February 1977	193
Dominica	10 August 1984	Approved by the Board, Sept. 1994	
Dominican Republic[c]	24 July 1971	In force: 11 October 1973	201
Ecuador[c]	7 March 1969	In force: 10 March 1975	231
Egypt	26 February 1981	In force: 30 June 1982	302
El Salvador[c]	11 July 1972	In force: 22 April 1975	232
Equatorial Guinea	1 November 1984	Approved by the Board, June 1986	
Eritrea	16 March 1995		
Estonia	31 January 1992	Approved by the Board, Feb. 1992	
Ethiopia	5 February 1970	In force: 2 December 1977	261
Fiji	14 July 1972	In force: 22 March 1973	192
Finland[i]	5 February 1969	Accession: 1 October 1995	193
Gabon	19 February 1974	Signed: 3 December 1979	
Gambia	12 May 1975	In force: 8 August 1978	277
Georgia	7 March 1994		
Germany[j]	2 May 1975	In force: 21 February 1977	193
Ghana	5 May 1970	In force: 17 February 1975	226
Greece[k]	11 March 1970	Accession: 17 December 1981	193
Grenada	19 August 1974		
Guatemala[c]	22 September 1970	In force: 1 February 1982	299
Guinea	29 April 1985		
Guinea-Bissau	20 August 1976		
Guyana	19 October 1993		
Haiti[c]	2 June 1970	Signed: 6 January 1975	
Holy See	25 February 1971	In force: 1 August 1972	187
Honduras[c]	16 May 1973	In force: 18 April 1975	235
Hungary	27 May 1969	In force: 30 March 1972	174
Iceland	18 July 1969	In force: 16 October 1974	215
Indonesia	12 July 1979	In force: 14 July 1980	283
Iran, Islamic Republic of	2 February 1970	In force: 15 May 1974	214
Iraq	29 October 1969	In force: 29 February 1972	172
Ireland	1 July 1968	In force: 21 February 1977	193
Italy	2 May 1975	In force: 21 February 1977	193
Jamaica[c]	5 March 1970	In force: 6 November 1978	265
Japan	8 June 1976	In force: 2 December 1977	255
Jordan	11 February 1970	In force: 21 February 1978	258
Kazakhstan	14 February 1994	In force: 11 August 1995	504
Kenya	11 June 1970		
Kiribati	18 April 1985	In force: 19 December 1990	390

Situation on 31 December 1995 with respect to the conclusion of safeguards agreements between the Agency and non-nuclear-weapon States in connection with NPT (cont.)

Non-nuclear-weapon States which have signed, ratified, acceded to or succeeded to NPT[a] (1)	Date of ratification, accession or succession[a] (2)	Safeguards agreement with the Agency (3)	INFCIRC (4)
Korea, Republic of	23 April 1975	In force: 14 November 1975	236
Kuwait	17 November 1989		
Kyrgyzstan	5 July 1994		
Lao People's Democratic Republic	20 February 1970	Signed: 22 November 1991	
Latvia	31 January 1992	In force: 21 December 1993	434
Lebanon	15 July 1970	In force: 5 March 1973	191
Lesotho	20 May 1970	In force: 12 June 1973	199
Liberia	5 March 1970		
Libyan Arab Jamahiriya	26 May 1975	In force: 8 July 1980	282
Liechtenstein	20 April 1978	In force: 4 October 1979	275
Lithuania	23 September 1991	In force: 15 October 1992	413
Luxembourg	2 May 1975	In force: 21 February 1977	193
Madagascar	8 October 1970	In force: 14 June 1973	200
Malawi	18 February 1986	In force: 3 August 1992	409
Malaysia	5 March 1970	In force: 29 February 1972	182
Maldives	7 April 1970	In force: 2 October 1977	253
Mali	10 February 1970		
Malta	6 February 1970	In force: 13 November 1990	387
Marshall Islands	30 January 1995		
Mauritania	26 October 1993		
Mauritius	25 April 1969	In force: 31 January 1973	190
Mexico[c]	21 January 1969	In force: 14 September 1973	197
Micronesia, Federated States of	14 April 1995		
Moldova	11 October 1994	Approved by the Board, Sept. 1995	
Monaco	13 March 1995		
Mongolia	14 May 1969	In force: 5 September 1972	188
Morocco	27 November 1970	In force: 18 February 1975	228
Mozambique	4 September 1990		
Myanmar	2 December 1992	In force: 20 April 1995	477
Namibia	2 October 1992		
Nauru	7 June 1982	In force: 13 April 1984	317
Nepal	5 January 1970	In force: 22 June 1972	186
Netherlands[l]	2 May 1975	In force: 21 February 1977	193
New Zealand[m]	10 September 1969	In force: 29 February 1972	185
Nicaragua[c]	6 March 1973	In force: 29 December 1976	246
Niger	9 October 1992		
Nigeria	27 September 1968	In force: 29 February 1988	358
Norway	5 February 1969	In force: 1 March 1972	177
Palau, Federated State of	14 April 1995		
Panama[c,n]	13 January 1977	Signed : 22 December 1988	

Table (cont.)

Non-nuclear-weapon States which have signed, ratified, acceded to or succeeded to NPT[a] (1)	Date of ratification, accession or succession[a] (2)	Safeguards agreement with the Agency (3)	INFCIRC (4)
Papua New Guinea	25 January 1982	In force: 13 October 1983	312
Paraguay[c]	4 February 1970	In force: 20 March 1979	279
Peru[c]	3 March 1970	In force: 1 August 1979	273
Philippines	5 October 1972	In force: 16 October 1974	216
Poland	12 June 1969	In force: 11 October 1972	179
Portugal[o]	15 December 1977	Accession: 1 July 1986	193
Qatar	3 April 1989		
Romania	4 February 1970	In force: 27 October 1972	180
Rwanda	20 May 1975		
St. Kitts and Nevis	22 March 1993	Approved by the Board, Sept. 1994	
St. Lucia	28 December 1979	In force: 2 February 1990	379
St. Vincent and the Grenadines	6 November 1984	In force: 8 January 1992	400
Samoa	17 March 1975	In force: 22 January 1979	268
San Marino	10 August 1970	Approved by the Board, Feb. 1977	
São Tome and Principe	20 July 1983		
Saudi Arabia	3 October 1988		
Senegal	17 December 1970	In force: 14 January 1980	276
Seychelles	12 March 1985		
Sierra Leone	26 February 1975	Signed: 10 November 1977	
Singapore	10 March 1976	In force: 18 October 1977	259
Slovakia[p]	1 January 1993	In force: 3 March 1972	173
Slovenia[q]	7 April 1992	In force: 28 December 1973	204
Solomon Islands	17 June 1981	In force: 17 June 1993	420
Somalia	5 March 1970		
South Africa	10 July 1991	In force: 16 September 1991	394
Spain	5 November 1987	Accession: 5 April 1989	193
Sri Lanka	5 March 1979	In force: 6 August 1984	320
Sudan	31 October 1973	In force: 7 January 1977	245
Suriname[c]	30 June 1976	In force: 2 February 1979	269
Swaziland	11 December 1969	In force: 28 July 1975	227
Sweden[r]	9 January 1970	Accession: 1 June 1995	193
Switzerland	9 March 1977	In force: 6 September 1978	264
Syrian Arab Republic	24 September 1969	In force: 18 May 1992	407
Thailand	7 December 1972	In force: 16 May 1974	241
The Former Yugoslav Republic of Macedonia	12 April 1995		
Togo	26 February 1970	Signed: 29 November 1990	
Tonga	7 July 1971	In force: 18 November 1993	426
Trinidad and Tobago[c]	30 October 1986	In force: 4 November 1992	414
Tunisia	26 February 1970	In force: 13 March 1990	381
Turkey	17 April 1980	In force: 1 September 1981	295

Situation on 31 December 1995 with respect to the conclusion of safeguards agreements between the Agency and non-nuclear-weapon States in connection with NPT (cont.)

Non-nuclear-weapon States which have signed, ratified, acceded to or succeeded to NPT[a] (1)	Date of ratification, accession or succession[a] (2)	Safeguards agreement with the Agency (3)	INFCIRC (4)
Turkmenistan	29 September 1994		
Tuvalu	19 January 1979	In force: 15 March 1991	391
Uganda	20 October 1982		
Ukraine[s]	5 December 1994	Signed: 21 September 1995	
United Arab Emirates	26 September 1995		
United Republic of Tanzania	7 June 1991	Signed: 26 August 1992	
Uruguay[c]	31 August 1970	In force: 17 September 1976	157
Uzbekistan	7 May 1992	In force: 8 October 1994	508
Venezuela[c]	26 September 1975	In force: 11 March 1982	300
Viet Nam	14 June 1982	In force: 23 February 1990	376
Yemen, Republic of	1 June 1979		
Yugoslavia (Serbia and Montenegro)[t], Federal Republic of	3 March 1970	In force: 28 December 1973	204
Zaire	4 August 1970	In force: 9 November 1972	183
Zambia	15 May 1991	In force: 22 September 1994	456
Zimbabwe	26 September 1991	In force: 26 June 1995	483

[a] The information reproduced in columns (1) and (2) was provided to the Agency by depositary governments of NPT, and an entry in column (1) does not imply the expression of any opinion on the part of the Secretariat concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers. The table does not contain information relating to the participation of Taiwan, China, in NPT.

[b] A sui generis comprehensive safeguards agreement with Albania entered into force on 25 March 1988 (INFCIRC/359).

[c] The relevant safeguards agreement refers to both NPT and the Treaty of Tlatelolco.

[d] The Board of Governors has concluded that the agreement between Argentina, Brazil, the ABACC and the Agency for the application of safeguards which entered into force on 4 March 1994 (INFCIRC/435) is compatible with the Treaty of Tlatelolco and the NPT.

[e] A comprehensive safeguards agreement with Chile concluded pursuant to the Treaty of Tlatelolco entered into force on 5 April 1995 (INFCIRC/476).

[f] A comprehensive safeguards agreement with Colombia concluded pursuant to the Treaty of Tlatelolco entered into force on 22 December 1982 (INFCIRC/306).

[g] The NPT safeguards agreement concluded with the Czechoslovak Socialist Republic (INFCIRC/173), which entered into force on 3 March 1972, continues to be applied in the Czech Republic to the extent relevant to the territory of the Czech Republic.

[h] The NPT safeguards agreement with Denmark (INFCIRC/176), in force since 1 March 1972, has been replaced by the agreement of 5 April 1973 between the non-nuclear-weapon States of EURATOM, EURATOM and the Agency (INFCIRC/193) but still applies to the Faroe Islands. Upon Greenland's secession from EURATOM as of 31 January 1985, the Agreement between the Agency and Denmark (INFCIRC/176) re-entered into force as to Greenland.

[i] The application of safeguards in Finland under the NPT safeguards agreement INFCIRC/155, in force since 9 February 1972, was suspended on 1 October 1995, on which date Finland acceded to the agreement of 5 April 1973 (INFCIRC/193) between the non-nuclear-weapon States of EURATOM, EURATOM and the Agency.

[j] The NPT safeguards agreement of 7 March 1972 concluded with the German Democratic Republic (INFCIRC/181) is no longer in force with effect from 3 October 1990, on which date the German Democratic Republic acceded to the Federal Republic of Germany.

[k] The application of safeguards in Greece under the NPT safeguards agreement INFCIRC/166, provisionally in force since 1 March 1972, was suspended on 17 December 1981, on which date Greece acceded to the agreement of 5 April 1973 (INFCIRC/193) between the non-nuclear-weapon States of EURATOM, EURATOM and the Agency.

[l] An agreement had also been concluded in respect of the Netherlands Antilles (INFCIRC/229). This agreement entered into force on 5 June 1975.

[m] The NPT safeguards agreement with New Zealand (INFCIRC/185) also applies to Cook Islands and Niue.

[n] A comprehensive safeguards agreement with Panama concluded pursuant to the Treaty of Tlatelolco entered into force on 23 March 1984 (INFCIRC/316).

[o] The application of safeguards in Portugal under the NPT safeguards agreement INFCIRC/272, in force since 14 June 1979, was suspended on 1 July 1986, on which date Portugal acceded to the agreement of 5 April 1973 (INFCIRC/193) between the non-nuclear-weapon States of EURATOM, EURATOM and the Agency.

[p] The NPT safeguards agreement concluded with the Czechoslovak Socialist Republic (INFCIRC/173), which entered into force on 3 March 1972, continues to be applied in Slovakia to the extent relevant to the territory of Slovakia.

[q] When Slovenia became an independent state, it succeeded to the safeguards agreement concluded with the Socialist Federal Republic of Yugoslavia (INFCIRC/204). A new NPT safeguards agreement concluded with Slovenia was approved by the Board of Governors on 8 June 1994.

[r] The application of safeguards in Sweden under the NPT safeguards agreement INFCIRC/234, in force since 14 April 1975, was suspended on 1 June 1995, on which date Sweden acceded to the agreement of 5 April 1973 (INFCIRC/193) between the non-nuclear-weapon States of EURATOM, EURATOM and the Agency.

[s] A sui generis comprehensive safeguards agreement with Ukraine entered into force on 13 January 1995 (INFCIRC/462). This agreement will remain in force until superseded by a new safeguards agreement to be concluded pursuant to NPT.

[t] The NPT safeguards agreement concluded with the Socialist Federal Republic of Yugoslavia (INFCIRC/204), which entered into force on 28 December 1973, continues to be applied in the Federal Republic of Yugoslavia (Serbia and Montenegro) to the extent relevant to the territory of the Federal Republic of Yugoslavia (Serbia and Montenegro).

Situation on 31 December 1995 with respect to the conclusion of safeguards agreements between the Agency and States party to the Treaty of Tlatelolco[a]

States party to the Treaty of Tlatelolco (1)	Date of becoming a party to the Treaty of Tlatelolco (2)	Safeguards agreement with the Agency (3)	INFCIRC (4)
Antigua and Barbuda[b]	11 October 1983	Signed: 1 February 1990	
Argentina[c]	18 January 1994		
Bahamas	26 April 1977		
Barbados[b]	25 April 1969	Approved by the Board, June 1995	
Belize[d]	4 November 1994		
Bolivia[b]	18 February 1969	In force: 6 February 1995	465
Brazil[c]	30 May 1994		
Chile	18 January 1994	In force: 5 April 1995	476
Colombia	6 September 1972	In force: 22 December 1982	306
Costa Rica[b]	25 August 1969	In force: 22 November 1979	278
Dominica[d]	25 August 1993		
Dominican Republic[b]	14 June 1968	In force: 11 October 1973	201
Ecuador[b]	11 February 1969	In force: 10 March 1975	231
El Salvador[b]	22 April 1968	In force: 22 April 1975	232
Grenada	20 June 1975		
Guatemala[b]	6 February 1970	In force: 1 February 1982	299
Haiti[b]	23 May 1969	Signed: 6 January 1975	
Honduras[b]	23 September 1968	In force: 18 April 1975	235
Jamaica[b]	26 June 1969	In force: 6 November 1978	265
Mexico[b,e]	20 September 1967	In force: 14 September 1973	197
Nicaragua[b]	24 October 1968	In force: 29 December 1976	246
Panama[f]	11 June 1971	In force: 23 March 1984	316
Paraguay[b]	19 March 1969	In force: 20 March 1979	279
Peru[b]	4 March 1969	In force: 1 August 1979	273
St. Lucia[g]	2 June 1995		
St. Vincent and the Grenadines[g]	11 May 1992		
Suriname[b]	10 June 1977	In force: 2 February 1979	269
Trinidad and Tobago[b]	27 June 1975	In force: 4 November 1992	414
Uruguay[b]	20 August 1968	In force: 17 September 1976	157
Venezuela[b]	23 March 1970	In force: 11 March 1982	300

In addition, there are the following safeguards agreements with States party to Additional Protocol I to the Treaty[h]:

Netherlands[b]	In force: 5 June 1975	229
United Kingdom	Approved by the Board, Sep.1992	
United States of America	In force: 6 April 1989	366

[a] The information reproduced in columns (1) and (2) was provided by Mexico as depositary of the Treaty of Tlatelolco.
In addition to the States listed in column (1), Guyana signed the Treaty on 16 January 1995 and St. Kitts and Nevis did so on 18 April 1995, but they have not yet become parties to the Treaty as they have not so far made the declation provided for in Article 28 of the Treaty. Cuba signed the Treaty on 25 March 1995.

[b] The relevant safeguards agreement refers to both the Treaty of Tlatelolco and NPT.

[c] The Board of Governors has concluded that the agreement between Argentina, Brazil, the ABACC and the Agency for the application of safeguards (INFCIRC/435) is compatible with the Treaty of Tlatelolco.

[d] A safeguards agreement pursuant to NPT has been concluded with this State; the agreement has not yet entered into force.

[e] The application of safeguards under an agreement with Mexico in connection with the Treaty of Tlatelolco which entered into force on 6 September 1968 (INFCIRC/118) was suspended after the conclusion of an agreement with Mexico in connection with both the Treaty of Tlatelolco and NPT (INFCIRC/197).

[f] A safeguards agreement pursuant to both the Treaty of Tlatelolco and NPT has been concluded with Panama; the agreement has not yet entered into force.

[g] A safeguards agreement pursuant to NPT is in force with this State.

[h] Additional Protocol I refers to States outside Latin America and the Caribbean which have de jure or de facto jurisdiction over territories which lie within the limits of the geographical zone established in the Treaty.

Agreements providing for safeguards, other than those in connection with NPT or the Treaty of Tlatelolco, approved by the Board as of 31 December 1995[a]

Party(ies)[b]	Subject	Entry into force	INFCIRC
(While the Agency is a party to each of the following agreements, only the State(s) party to them is (are) listed.)			
(i) Project agreements			
Argentina	Siemens SUR-100	13 March 1970	143
	RAEP Reactor[c]	2 December 1964	62
Chile[d]	Herald Reactor	19 December 1969	137
Colombia[d]	Fuel for research reactor	17 June 1994	460
Finland[e]	FIR-1 Reactor	30 December 1960	24
	FINN sub-critical assembly	30 July 1963	53
Ghana[e]	Research reactor and fuel therefore	14 October 1994	468
Greece[e]	GRR-1 Reactor	1 March 1972	163
Indonesia[e]	Additional core-load for TRIGA Reactor	19 December 1969	136
	Supply of enriched uranium	15 January 1993	453
	Supply of enriched uranium	15 January 1993	454
Iran, Islamic Republic of[e]	UTRR Reactor	10 May 1967	97
Jamaica[e]	Fuel for research reactor	25 January 1984	315
Japan[e]	JRR-3	24 March 1959	3
Malaysia[e]	TRIGA-II Reactor	22 September 1980	287
Mexico[e]	TRIGA-III Reactor	18 December 1963	52
	Siemens SUR-100	21 December 1971	162
	Laguna Verde Nuclear Power Plant	12 February 1974	203
Morocco[e]	Fuel for research reactor	2 December 1983	313
Pakistan	PRR Reactor	5 March 1962	34
	Booster rods for KANUPP	17 June 1968	116
Peru[e]	Research reactor and fuel therefore	9 May 1978	266
Philippines[e]	PRR-1 Reactor	28 September 1966	88
Romania[e]	TRIGA Reactor	30 March 1973	206
	Experimental fuel elements	1 July 1983	307
Slovenia[e]	TRIGA-II Reactor	4 October 1961	32
	Krško Nuclear Power Plant	14 June 1974	213
Spain[e]	Coral-I Reactor	23 June 1967	99
Syrian Arab Republic[e]	Miniature neutron source reactor and enriched uranium	18 May 1992	408
Thailand[e]	Fuel for research reactor	30 September 1986	342
Turkey[e]	Subcritical assembly	17 May 1974	212
Uruguay[e]	URR Reactor	24 September 1965	67
Venezuela[e]	RV-1 Reactor	7 November 1975	238
Viet Nam[e]	Fuel for research reactor	1 July 1983	308
Zaire[e]	TRICO Reactor	27 June 1962	37
	Fuel for research reactor	20 September 1990	389

Table (cont.)

Party(ies)[b]	Subject	Entry into force	INFCIRC
(ii) Unilateral submissions			
Algeria	Nur research reactor	9 April 1990	361
	Es Salam research reactor	2 June 1992	401
Argentina	Atucha Power Reactor Facility [f]	3 October 1972	168
	Nuclear material [f]	23 October 1973	202
	Embalse Power Reactor Facility [f]	6 December 1974	224
	Equipment and nuclear material [f]	22 July 1977	250
	Nuclear material, material, equipment and facilities [f]	22 July 1977	251
	Atucha II Nuclear Power Plant [f]	15 July 1981	294
	Heavy water plant [f]	14 October 1981	296
	Heavy water [f]	14 October 1981	297
	Nuclear material [f]	8 July 1982	303
Chile	Nuclear material[g]	31 December 1974	256
	Nuclear material[g]	22 September 1982	304
	Nuclear material[g]	18 September 1987	350
Cuba	Nuclear power plant and nuclear material	5 May 1980	281
	Zero-power nuclear reactor and fuel therefore	7 October 1983	311
Democratic People's Republic of Korea	Research reactor and nuclear material therefore[h]	20 July 1977	252
India	Nuclear material, material and facilities	17 November 1977	260
	Nuclear power station	27 September 1988	360
	Nuclear material	11 October 1989	374
	All nuclear material subject to safeguards under INFCIRC/154	1 March 1994	433*
Pakistan	Nuclear material	2 March 1977	248
	Miniature neutron source reactor	10 September 1991	393
	Nuclear power reactor	24 February 1993	418
Spain	Nuclear material[h]	18 June 1975	221
	Vandellos Nuclear Power Plant[h]	11 May 1981	292
	Specified nuclear facilities[h]	11 May 1981	291**
United Kingdom	Nuclear material	14 December 1972	175
Viet Nam	Research reactor and fuel therefore[h]	12 June 1981	293

* Amended in 1994 to cover nuclear material supplied for use in the Tarapur Atomic Power Station (TAPS) which material is required by the supplier to be subject to safeguards. The amendment entered into force on 12 September 1994 (INFCIRC/433/Mod.1).

** Amended in 1985 to cover specified nuclear facilities. The amendment entered into force on 8 November 1985 INFCIRC/291/Mod.1/Corr.1).

Agreements providing for safeguards, other than those in connection with NPT or the Treaty of Tlatelolco, approved by the Board as of 31 December 1995[a] (cont.)

Party(ies)[b]	Subject	Entry into force	INFCIRC
(iii) Agreements concluded with nuclear-weapon States on the basis of voluntary offers			
China	Nuclear material in facilities selected from list of facilities provided by China	18 September 1989	369
France	Nuclear material in facilities submitted to safeguards	12 September 1981	290
Russian Federation	Nuclear material in facilities selected from list of facilities provided by the Russian Federation	10 June 1985	327
United Kingdom	Nuclear material in facilities designated by the Agency	14 August 1978	263
United States of America	Nuclear material in facilities designated by the Agency	9 December 1980	288
(iv) Other comprehensive safeguards ageements			
Albania	All nuclear material and facilities	25 March 1988	359
Argentina/Brazil	All nuclear material in all nuclear activities	4 March 1994	435
Ukraine	All nuclear material in all peaceful nuclear activities	13 January 1995	462
(v) Other safeguards agreements			
Argentina/United States of America		25 July 1969	130
Austria[h]/United States of America		24 January 1970	152
Brazil/Germany[h]		26 February 1976	237
Brazil/United States of America		31 October 1968	110
Colombia/United States of America		9 December 1970	144
India/Canada[h]		30 September 1971	211
Iran, Islamic Republic of [h]/United States of America		20 August 1969	127
Israel/United States of America		4 April 1975	249
Japan[h]/Canada[h]		20 June 1966	85
Japan[h]/France		22 September 1972	171
Japan/United Kingdom		15 October 1968	125
Korea, Republic of/United States of America		5 January 1968	111

Table (cont.)

Party(ies)[b]	Subject	Entry into force	INFCIRC
Korea, Republic of [h]/France		22 September 1975	233
Pakistan/Canada		17 October 1969	135
Pakistan/France		18 March 1976	239
Philippines[h]/United States of America		19 July 1968	120
Portugal[h]/United States of America[i]		19 July 1969	131
South Africa/United States of America		26 July 1967	98
South Africa/France		5 January 1977	244
Spain/Germany[h]		29 September 1982	305
Spain[h]/United States of America[i]		9 December 1966	92
Spain/Canada[h]		10 February 1977	247
Sweden[h]/United States of America		1 March 1972	165
Switzerland[h]/United States of America[i]		28 February 1972	161
Turkey[h]/United States of America[i]		5 June 1969	123
Venezuela[h]/United States of America[i]		27 March 1968	122

(vi) The Agency also applies safeguards under two agreements (INFCIRC/133 and INFCIRC/158) to the nuclear facilities in Taiwan, China. Pursuant to the decision adopted by the Board of Governors on 9 December 1971 that the Government of the People's Republic of China is the only government which has the right to represent China in the Agency, the relations between the Agency and the authorities in Taiwan, China are non-governmental. The agreements are implemented by the Agency on that basis.

[a] Safeguards agreements pursuant to the South Pacific Nuclear Weapon Free Zone Treaty (Rarotonga Treaty) are not separately listed with this compilation since the Treaty requires that safeguards by the Agency will be applied pursuant to safeguards agreements equivalent in scope and effect to an agreement required in connection with the NPT on the basis of the material reproduced in INFCIRC/153 (Corrected). As of 31 December 1995, all 11 States Party to the Treaty (Australia, Cook Islands, Fiji, Kiribati, Nauru, New Zealand, Niue, Papua New Guinea, Solomon Islands, Tuvalu and Samoa) were covered by safeguards agreements concluded pursuant to NPT.

[b] An entry in this column does not imply the expression of any opinion whatsoever on the part of the Secretariat concerning the legal status of any country or territory or of its authorities or concerning the delimitation of its frontiers.

[c] Agency safeguards required by this project agreement are implemented pursuant to the comprehensive safeguards agreement concluded between Argentina, Brazil, the ABACC and the Agency (INFCIRC/435).

[d] Agency safeguards required by this project agreement are implemented pursuant to a safeguards agreement in connection with the Treaty of Tlatelolco covering the State indicated.

[e] Agency safeguards required by this (these) project agreement(s) are implemented pursuant to an agreement in connection with NPT covering the State indicated.

[f] Application of Agency safeguards under this agreement has been suspended. Safeguards are applied pursuant to the comprehensive safeguards agreement concluded between Argentina, Brazil, the ABACC and the Agency (INFCIRC/435).

[g] Application of Agency safeguards under this agreement has been suspended in the State indicated as the State has concluded an agreement in connection with the Treaty of Tlatelolco.

[h] Application of Agency safeguards under this agreement has been suspended in the State indicated as the State has concluded an agreement in connection with NPT.

[i] Application of Agency safeguards under this agreement has been suspended in the United States of America in order to comply with a provision of INFCIRC/228.

Approximate quantities of material subject to Agency safeguards at the end of 1995

Type of material	Quantity of material (t)			
	Comprehensive safeguards agreements[a]	INFCIRC/66[b]	Nuclear-weapon States	Quantity in SQs
Nuclear material				
Plutonium[c] contained in irradiated fuel	373.5	28.7	106.3	63 552
Separated plutonium outside reactor cores	11.0	0.1	34.0	5 631
Recycled plutonium in fuel elements in reactor cores	3.8	0.2	0	504
HEU (equal to or greater than 20% ^{235}U)	10.0	0.4	10	608
LEU (less than 20% ^{235}U)	36 887	2 414	7 959	13 286
Source material[d] (natural or depleted uranium and thorium)	70 221	3 982	30 192	6 681
Non-nuclear material[e]				
Heavy water	0	573	0	29
Total significant quantities				90 291

[a] Covering safeguards agreements pursuant to NPT and/or Treaty of Tlatelolco and other comprehensive safeguards statements.
[b] Excluding installations in nuclear-weapon States; including installations in Taiwan, China.
[c] The quantity includes an estimated 83.6 t (10 450 SQ) of plutonium in irradiated fuel, which is not yet reported to the Agency under the reporting procedures agreed to (the non-reported plutonium is contained in irradiated fuel assemblies to which item accountancy and C/S measures are applied).
[d] This table does not include material within the terms of subparagraphs 34(a) and (b) of INFCIRC/153 (Corrected).
[e] Non-nuclear material subject to Agency safeguards under INFCIRC/66/Rev.2-type agreements.

Number of facilities under safeguards or containing safeguarded material on 31 December 1995

Facility type	Number of facilities (number of installations)			
	Comprehensive safeguards agreements[a]	INFCIRC/66[b]	Nuclear-weapon States	Total
Power reactors	175 (212)	10 (13)	1 (1)	186 (226)
Research reactors and critical assemblies	150 (162)	11 (11)	1 (1)	162 (174)
Conversion plants	12 (12)	1 (1)	0 (0)	13 (13)
Fuel fabrication plants	35 (37)	4 (4)	0 (0)	39 (41)
Reprocessing plants	5 (5)	1 (1)	0 (0)	6 (6)
Enrichment plants	9 (9)	0 (0)	2 (2)	11 (11)
Separate storage facilities	53 (54)	1 (1)	7 (7)	61 (62)
Other facilities	69 (73)	1 (1)	0 (0)	70 (74)
Subtotals	508 (564)	29 (32)	11 (11)	548 (607)
Other locations	331 (481)	3 (22)	0 (0)	334 (503)
Non-nuclear installations	0 (0)	2 (2)	0 (0)	2 (2)
Totals	839 (1045)	34 (56)	11 (11)	884 (1112)

a Covering safeguards agreements pursuant to NPT and/or Treaty of Tlatelolco and other comprehensive safeguards agreements; excludes locations in Iraq.
b Excluding installations in nuclear-weapon States; including installations in Taiwan, China.

Facilities under Agency safeguards or containing safeguarded material on 31 December 1995

Power reactors

State[a]	Abbreviated name of facility	Number of reactor units	Location	Subsidiary arrangements in force
Argentina	Atucha NPP	1	Lima	—
	Embalse NPP	1	Embalse	—
Armenia	Armenia NPP	2	Medsamor	—
Belgium	BR3-Mol	1	Mol	x
	DOEL-1	2	Doel	x
	DOEL-3	1	Doel	x
	DOEL-4	1	Doel	x
	Tihange-1	1	Tihange	x
	Tihange-2	1	Tihange	x
	Tihange-3	1	Tihange	x
Brazil	Admiral Alvaro Alberto	1	Angra dos Reis	—
Bulgaria	Kozloduy-I	2	Kozloduy	x
	Kozloduy-II	2	Kozloduy	x
	Kozloduy-III	2	Kozloduy	x
Canada	Bruce A	4	Tiverton	x
	Bruce B	4	Tiverton	x
	Darlington N.G.S.	4	Bowmanville	x
	Gentilly-2	1	Gentilly	x
	Pickering G.S.	8	Pickering	x
	Point Lepreau G.S.	1	Point Lepreau	x
China	QSNPP	1	Hai Yan	x
Cuba	Juragua	2	Juragua	x
Czech Republic	EDU-1	2	Dukovany	x
	EDU-2	2	Dukovany	x
Democratic People's Republic of Korea	Nyongbyon-1	1	Nyongbyon	—
Finland	Loviisa	2	Loviisa	—
	TVO-1	1	Olkiluoto	—
	TVO-2	1	Olkiluoto	—
Germany	AVR	1	Jülich	—
	KWG Grohnde	1	Grohnde	—
	GKN-2	1	Neckarwestheim	x
	RWE Biblis-A	1	Biblis	x
	RWE Biblis-B	1	Biblis	x
	KBR Brokdorf	1	Brokdorf	—
	KKB Brunsbüttel	1	Brunsbüttel	x
	KKE Emsland	1	Lingen	x
	KKG Grafenrheinfeld	1	Grafenrheinfeld	—
	KKI Isar-Ohu	1	Ohu bei Landshut	x
	KKI Isar-2	1	Essenbach	x
	KKK Krümmel	1	Geesthacht	x
	RWE Mühlheim-Kärlich	1	Mühlheim-Kärlich	x
	GKN Neckarwestheim	1	Neckarwestheim	x
	KWO Obrigheim	1	Obrigheim	x

Power reactors (cont.)

State[a]	Abbreviated name of facility	Number of reactor units	Location	Subsidiary arrangements in force
Germany (cont.)	KKP Philippsburg-1	1	Philippsburg	x
	KKP Philippsburg-2	1	Philippsburg	—
	KRB II Gundremmingen B	1	Gundremmingen	x
	KRB II Gundremmingen C	1	Gundremmingen	x
	KKS Stade	1	Stade	x
	KKU Unterweser	1	Unterweser	x
	KWW Würgassen	1	Würgassen	x
	HKG-THTR 300	1	Hamm	—
	KKW Greifswald 1	2	Greifswald	—
	KKW Greifswald 2	2	Greifswald	—
	KKW Greifswald 3	1	Greifswald	—
	KKW Rheinsberg	1	Rheinsberg	x
Hungary	PAKS-I	2	Paks	x
	PAKS-II	2	Paks	x
India	RAPS	2	Rajasthan	x
	TAPS	2	Tarapur	x
Italy	ENEL-Latina	1	Borgo-Sabatino	x
	ENEL-Caorso	1	Caorso	x
	ENEL-Trino	1	Trino-Vercellese	x
Japan	Fugen	1	Tsuruga-shi, Fukui-ken	x
	Fukushima Dai-Ichi-1	1	Futaba-gun, Fukushima-ken	x
	Fukushima Dai-Ichi-2	1	Futaba-gun, Fukushima-ken	x
	Fukushima Dai-Ichi-3	1	Futaba-gun, Fukushima-ken	x
	Fukushima Dai-Ichi-4	1	Futaba-gun, Fukushima-ken	x
	Fukushima Dai-Ichi-5	1	Futaba-gun, Fukushima-ken	x
	Fukushima Dai-Ichi-6	1	Futaba-gun, Fukushima-ken	x
	Fukushima Dai-Ni-1	1	Futaba-gun, Fukushima-ken	x
	Fukushima Dai-Ni-2	1	Futaba-gun, Fukushima-ken	x
	Fukushima Dai-Ni-3	1	Futaba-gun, Fukushima-ken	x
	Fukushima Dai-Ni-4	1	Futaba-gun, Fukushima-ken	x
	Genkai-1	1	Higashimatsura-gun, Saga-ken	x
	Genkai-2	1	Higashimatsura-gun, Saga-ken	x
	Genkai-3	1	Higashimatsura-gun, Saga-ken	—
	Hamaoka-1	1	Ogasa-gun, Shizuoka-ken	x
	Hamaoka-2	1	Ogasa-gun, Shizuoka-ken	x
	Hamaoka-3	1	Ogasa-gun, Shizuoka-ken	x
	Hamaoka-4	1	Ogasa-gun, Shizuoka-ken	—
	Ikata-1	1	Nishiuwa-gun, Ehime-ken	x
	Ikata-2	1	Nishiuwa-gun, Ehime-ken	x
	Ikata-3	1	Nishiuwa-gun, Ehime-ken	—
	Joyo	1	Higashi-gun, Ibaraki-ken	x
	Kashiwazaki-1	1	Kashiwazaki-shi, Niigata-ken	x
	Kashiwazaki-2	1	Kashiwazaki-shi, Niigata-ken	x
	Kashiwazaki-3	1	Kashiwazaki-shi, Niigata-ken	—
	Kashiwazaki-4	1	Kashiwazaki-shi, Niigata-ken	—
	Kashiwazaki-5	1	Kashiwazaki-shi, Niigata-ken	x
	Kashiwazaki-6	1	Kashiwazaki-shi, Niigata-ken	—
	Mihama-1	1	Mikata-gun, Fukui-ken	x
	Mihama-2	1	Mikata-gun, Fukui-ken	x
	Mihama-3	1	Mikata-gun, Fukui-ken	x

Power reactors (cont.)

State[a]	Abbreviated name of facility	Number of reactor units	Location	Subsidiary arrangements in force
Japan (cont.)	Monju	1	Tsuruga-shi, Fukui-ken	x
	Ohi-1&2	2	Ohi-gun, Fukui-ken	x
	Ohi-3	1	Ohi-gun, Fukui-ken	x
	Ohi-4	1	Ohi-gun, Fukui-ken	x
	Onagawa-1	1	Oshika-gun, Miyaki-ken	x
	Onagawa-2	1	Oshika-gun, Miyaki-ken	—
	Sendai-1	1	Sendai-shi, Kagashima-ken	x
	Sendai-2	1	Sendai-shi, Kagashima-ken	x
	Shika	1	Hakui-gun, Ishikawa-ken	—
	Shimane-1	1	Yatsuka-gun, Shimane-ken	x
	Shimane-2	1	Yatsuka-gun, Shimane-ken	x
	Takahama-1	1	Ohi-gun, Fukui-ken	x
	Takahama-2	1	Ohi-gun, Fukui-ken	x
	Takahama-3	1	Ohi-gun, Fukui-ken	x
	Takahama-4	1	Ohi-gun, Fukui-ken	x
	Tokai-1	1	Tokai-Mura, Ibaraki-ken	x
	Tokai-2	1	Tokai-Mura, Ibaraki-ken	x
	Tomari-1	1	Furuu-gun, Hokkaido	x
	Tomari-2	1	Furuu-gun, Hokkaido	x
	Tsuruga-1	1	Tsuruga-shi, Fukui-ken	x
	Tsuruga-2	1	Tsuruga-shi, Fukui-ken	x
Kazakhstan	BN-350	1	Aktau	—
Korea, Republic of	Kori-1	1	Pusan	x
	Kori-2	1	Pusan	x
	Kori-3	1	Pusan	x
	Kori-4	1	Pusan	x
	Ulchin-1	1	Ulchin	x
	Ulchin-2	1	Ulchin	x
	Wolsong-1	1	Kyongju	x
	Younggwang 1	1	Younggwang	x
	Younggwang 2	1	Younggwang	x
	Younggwang-3	1	Younggwang	x
	Younggwang-4	1	Younggwang	x
Lithuania	Ignalina NPP	2	Visaginas	—
Mexico	Laguna Verde	2	Alto Lucero	x
Netherlands	Borssele	1	Borssele	x
	Dodewaard NPP	1	Dodewaard	x
Pakistan	KANUPP	1	Karachi	x
Philippines	PNPP-1	1	Morong, Bataan	x
Romania	Cernavoda-1	1	Cernavoda	—
Slovakia	A1	1	Bohunice	x
	EMO-1	2	Mochovce	—
	V-1	2	Bohunice	x
	V-2	2	Bohunice	x
Slovenia	Krško	1	Krško	x
South Africa	Koeberg-1	1	Cape Town	x
	Koeberg-2	1	Cape Town	x
Spain	Almaraz-1	1	Almaraz	—
	Almaraz-2	1	Almaraz	—

Power reactors (cont.)

State[a]	Abbreviated name of facility	Number of reactor units	Location	Subsidiary arrangements in force
Spain (cont.)	Asco-1	1	Asco	—
	Asco-2	1	Asco	—
	Cofrentes	1	Cofrentes	—
	José Cabrera	1	Almonazid de Zorita	—
	Santa María de Garona	1	Santa María de Garona	—
	Trillo-1	1	Trillo	—
	Vandellos 1	1	Vandellos	—
	Vandellos 2	1	Vandellos	—
Sweden	Barsebäck 1	1	Malmö	—
	Barsebäck 2	1	Malmö	—
	Forsmark 1	1	Uppsala	—
	Forsmark 2	1	Uppsala	—
	Forsmark 3	1	Uppsala	—
	Oskarshamn 1	1	Oskarshamn	—
	Oskarshamn 2	1	Oskarshamn	—
	Oskarshamn 3	1	Oskarshamn	—
	Ringhals 1	1	Göteborg	—
	Ringhals 2	1	Göteborg	—
	Ringhals 3	1	Göteborg	—
	Ringhals 4	1	Göteborg	—
Switzerland	KKB Beznau I	1	Beznau	x
	KKB Beznau II	1	Beznau	x
	KKG Gösgen	1	Gösgen-Däniken	x
	KKL Leibstadt	1	Leibstadt	x
	KKM Mühleberg	1	Mühleberg	x
Ukraine	Chernobyl NPP	3	Chernobyl	—
	Khmelnitski 1	1	Neteshin	—
	Rovno 1 & 2	2	Kuznetsovsk	—
	Rovno 3	1	Kuznetsovsk	—
	South Ukraine 1	1	Yuzhnoukrainsk	—
	South Ukraine 2	1	Yuzhnoukrainsk	—
	South Ukraine 3	1	Yuzhnoukrainsk	—
	Zaporozhe 1	1	Energodar	—
	Zaporozhe 2	1	Energodar	—
	Zaporozhe 3	1	Energodar	—
	Zaporozhe 4	1	Energodar	—
	Zaporozhe 5	1	Energodar	—
	Zaporozhe 6	1	Energodar	—

Research reactors and critical assemblies

State[a]	Abbreviated name of facility	Number of reactor units	Location	Subsidiary arrangements in force
Algeria	NUR Reactor	1	Algiers	x
	Es Salam research reactor	1	Ain Oussera	—
Argentina	Argentine reactor-1	1	Constituyentes	—
	Argentine reactor-3	1	Ezeiza	—
	Argentine reactor-4	1	Rosario	—
	Argentine reactor-6	1	Bariloche	—
	Argentine reactor-0	1	Córdoba	—
Australia	HIFAR	1	Lucas Heights	x
	MOATA	1	Lucas Heights	x
	CF	1	Lucas Heights	x
Austria	ASTRA	1	Seibersdorf	x
	Siemens Argonaut Reactor	1	Graz	x
	Triga II	1	Vienna	x
Bangladesh	Atomic Energy Research Est.	1	Dhaka	x
Belgium	BR1-CEN	1	Mol	x
	BR2-CEN-BRO2	2	Mol	x
	CEN-Venus	1	Mol	x
	Thetis	1	Gent	x
Brazil	IEA-R1	1	São Paulo	—
	RIEN-1 Argonaut RR	1	Rio de Janeiro	—
	IPR-RI-CDTN	1	Belo Horizonte	—
	IPEN Critical assembly	1	São Paulo	—
	Subcritical assembly	1	Rio de Janeiro	—
	Subcritical assembly	1	Recife	—
Bulgaria	IRT-2000	1	Sofia	x
Canada	Biology, Chemistry, Physics	2	Chalk River	x
	McMaster	1	Hamilton	x
	NRU	1	Chalk River	x
	NRX	1	Chalk River	x
	Slowpoke-AECL	1	Ottawa	x
	Slowpoke-Dalhousie Univ.	1	Halifax	x
	Slowpoke-Ecole Polytechnique	1	Montreal	x
	Slowpoke-Kingston	1	Kingston	x
	Slowpoke-Saskatchewan	1	Saskatoon	x
	Slowpoke-Univ. of Toronto	1	Toronto	x
	Slowpoke-Univ. of Alberta	1	Edmonton	x
Chile	La Reina	1	Santiago	—
	Lo Aguirre	1	Santiago	—
China	HWRR	1	Beijing	x
Colombia	IAN-R1	1	Bogotá	—
Czech Republic	LR-O	1	Řež	x
	SR-OD	1	Vochov	x
	Univ. Training Reactor VR-1P	1	Prague	x
	VVR-S	1	Řež	x
Democratic People's Republic of Korea	Critical Assembly	1	Bungang-Ri, Nyongbyon	x
	IRT	1	Bungang-Ri, Nyongbyon	x

Research reactors and critical assemblies (cont.)

State[a]	Abbreviated name of facility	Number of reactor units	Location	Subsidiary arrangements in force
Denmark	DR-1	1	Roskilde	x
	DR-3	1	Roskilde	x
Egypt	RR-I	1	Inshas	x
Finland	FIR 1	1	Otaniemi	—
Germany	BER-2	1	Berlin	x
	PTB	1	Braunschweig	x
	FH-Furtwangen	1	Furtwangen	x
	FRF-2	1	Frankfurt	x
	FRM	1	Garching	x
	GKSS-FRG1&FRG2	2	Geesthacht	x
	KFA-FRJ2	1	Jülich	x
	SUR 100	1	Bremen	x
	SUR 100	1	Eggenstein-Leopoldshafen	x
	SUR 100	1	Hannover	x
	SUR 100	1	Kiel	x
	SUR 100	1	Hamburg	x
	SUR 100	1	Ulm	x
	SUR 100	1	Stuttgart	x
	SUR 100	1	Darmstadt	x
	SUR 100	1	Berlin	x
	SUR 100	1	Aachen	x
	Tech. Univ. AKR	1	Dresden	x
	Tech. Hochschule ZLR	1	Zittau	x
	Triga	1	Mainz	x
	MHH-Triga	1	Hannover	x
	DKFZ-Triga	1	Heidelberg	x
	VKT RAKE & RRR	2	Rossendorf	x
	VKT research reactor	1	Rossendorf	x
Ghana	GHARR-1	1	Legon-Accra	—
Greece	GRR-1	1	Attiki	x
Hungary	Training reactor	1	Budapest	x
	WWR-S M 10	1	Budapest	x
Indonesia	Gama	1	Yogyakarta	x
	MPR-30	1	Serpong	x
	PPTN	1	Bandung	x
Iran, Islamic Republic of	TRR	1	Tehran	x
	HWZPR	1	Esfahan	—
	MNSR	1	Esfahan	—
Israel	IRR-1	1	Soreq	x
Italy	AGN-201	1	Palermo	x
	Poltec.	1	Milan	x
	RTS-1	1	San Piero a Grado	x
	TAPIRO	1	Santa Maria di Galeria	x
	Triga-RC1	1	Santa Maria di Galeria	x
	Triga-2	1	Pavia	x
Jamaica	Centre for Nuclear Sciences	1	Kingston	x

Research reactors and critical assemblies (cont.)

State[a]	Abbreviated name of facility	Number of reactor units	Location	Subsidiary arrangements in force
Japan	DCA	1	Oarai-machi, Ibaraki-ken	x
	FCA	1	Tokai-Mura, Ibaraki-ken	x
	HTR	1	Kawasaki-shi, Kanagawa-ken	x
	JMTR	1	Higashi-gun, Ibaraki-ken	x
	JMTRCA	1	Higashi-gun, Ibaraki-ken	x
	JRR-2	1	Tokai-Mura, Ibaraki-ken	x
	JRR-3	1	Tokai-Mura, Ibaraki-ken	x
	JRR-4	1	Tokai-Mura, Ibaraki-ken	x
	Kinki University reactor	1	Higashiosaka-shi, Osaka-fu	x
	KUCA	3	Osaka	x
	KUR	1	Sennan-gun, Osaka	x
	Musashi reactor	1	Kawasaki-shi, Kanagawa-ken	x
	N.S. Mutsu	1	Mutsui-shi, Aomori-ken	x
	NCA	1	Kawasaki-shi	x
	NSRR	1	Tokai-Mura, Ibaraki-ken	x
	Rikkyo University R.R.	1	Nagasaka, Kanagawa-ken	x
	TCA	1	Tokai-Mura, Ibaraki-ken	x
	TODAI	1	Tokai-Mura, Ibaraki-ken	x
	TTR	1	Kawasaki-shi, Kanagawa-ken	x
	VHTRC	1	Tokai-Mura, Ibaraki-ken	x
Kazakhstan	Kurchatov Test Reactor	2	Semipalatinsk	—
	WWR-K	1	Almaty	—
Korea, Republic of	Triga II&III	2	Seoul	x
	Kyunghee Univ.	1	Suwoon	x
	Hanaro	1	Taejon	—
Latvia	IRT	1	Riga	—
Libyan Arab Jamahiriya	IRT Reactor	1	Tajura	x
Malaysia	Puspati	1	Bangi, Selangor	x
Mexico	Triga Mark III	1	Ocoyoacac	x
Netherlands	HOR	1	Delft	x
	HFR	1	Petten	x
	LFR	1	Petten	x
Norway	HBWR-Halden	1	Halden	x
	JEEP-II	1	Kjeller	x
Pakistan	PARR-1	1	Rawalpindi	x
	PARR-2	1	Rawalpindi	x
Peru	RP-0	1	Lima	x
	RP-10	1	Lima	x
Philippines	PRR-1	1	Quezon City, Diliman	x
Poland	Agata&Anna	2	Świerk	x
	Ewa	1	Świerk	x
	Maria	1	Świerk	x
Portugal	RPI	1	Sacavem	x
Romania	Triga II	1	Pitești Colibași	x
	VVR-S	2	Magurele	x
Slovenia	Triga II	1	Ljubljana	x

Research reactors and critical assemblies (cont.)

State[a]	Abbreviated name of facility	Number of reactor units	Location	Subsidiary arrangements in force
South Africa	SAFARI-1	1	Pelindaba	x
Sweden	Studsvik RR	2	Studsvik	—
Switzerland	AGN 211P	1	Basel	x
	Crocus	1	Lausanne	x
	Proteus	1	Würenlingen	x
	Saphir	1	Würenlingen	x
Syrian Arab Republic	MNSR		Damascus	—
Thailand	TRR-1	1	Bangkok	x
Turkey	Cekmece Nuclear Research Training Centre	1	Istanbul	x
	ITU-TRR Triga Mark II	1	Istanbul	x
Ukraine	Kiev RR	1	Kiev	—
	Sevastopol Navy College	1	Sevastopol	—
Uruguay	Centro Investigaciones Nucleares	1	Montevideo	x
Venezuela	RV-I	1	Altos de Pipe	x
Viet Nam	Da Lat Research Reactor	1	Da Lat, Lam Dong	x
Yugoslavia (Serbia and Montenegro), Fed. Rep. of	RA-RB	2	Vinča	x
Zaire	Zaire Triga II	1	Kinshasa	x

Conversion plants, including pilot plants

State[a]	Abbreviated name of facility	Location	Subsidiary arrangements in force
Argentina	UF_6 Production Facility	Pilcaniyeu	—
	UO_2 Conversion Plant	Córdoba	—
Canada	CAMECO	Port Hope	x
Chile	Lab. exper. de conversión	Santiago	—
Japan	JCO conv. plant	Tokai-Mura, Ibaraki-ken	x
	Ningyo R & D	Tomata-gun, Okayama-ken	x
	PCDF	Tokai-Mura, Ibaraki-ken	x
Romania	UO_2 powder fabrication plant	Feldioara	—
South Africa	Conversion plant	Pelindaba	—
	HEU-UF_6 Production Plant	Pelindaba	x
Sweden	Ranstad Mineral	Ranstad	—

Fuel fabrication plants, including pilot plants

State[a]	Abbreviated name of facility	Location	Subsidiary arrangements in force
Argentina	Fuel Fabrication Plant	Ezeiza	—
	Fuel Fabrication Plant	Constituyentes	—
Belgium	BN-MOX	Dessel	x
	FBFC	Dessel	x
	FBFC MOX	Dessel	—
Brazil	Fuel Fabrication Plant	Resende	—
Canada	CRNL Fuel Fabrication	Chalk River	x
	Fuel fabrication facility	Chalk River	x
	GEC Inc.	Toronto	x
	GEC Inc.	Peterborough	x
	Zircatec	Port Hope	x
Democratic People's Republic of Korea	Nuclear Fuel Fabrication Plant	Nyongbyon	—
Denmark	Metallurgy	Roskilde	x
Germany	Adv. Nuclear Fuels	Lingen	x
	NUKEM	Wolfgang	x
	Siemens Uran (two units)	Hanau	x
	Siemens MOX	Hanau	x
India	Ceramic Fuel Fab. Assembly Area	Hyderabad	x
	EFFP-NFC	Hyderabad	x
Indonesia	Experimental Fuel Element Installation (IEBE)	Serpong	x
	Research Reactor Fuel Element Production Installation (IPEBRR)	Serpong	x
Italy	Fabnuc	Bosco Marengo	x
Japan	JNF	Yokosuka-shi, Kanagawa-ken	x
	MNF	Tokai-Mura, Ibaraki-ken	x
	NFI (Kumatori-1)	Sennan-gun, Osaka	x
	NFI (Kumatori-2)	Sennan-gun, Osaka	x
	NFI Tokai	Tokai-Mura, Ibaraki-ken	x
	PFPF	Tokai-Mura, Ibaraki-ken	x
	PPFF	Tokai-Mura, Ibaraki-ken	x
Kazakhstan	Ulbinski Metallurgical Works	Kamenogorsk	—
Korea, Republic of	CANDU Fuel Fabrication Plant	Taejon	x
	KNFFP	Taejon	x
Mexico	Fuel fabrication pilot plant	Ocoayacac	x
Romania	Romfuel	Piteşti Colibaşti	x
South Africa	MTR fuel fabrication	Pelindaba	—
	LEU fuel fabrication	Pelindaba	x
Spain	ENUSA Fuel Fabrication Plant	Juzbado	—
Sweden	ABB	Västeras	—

Chemical reprocessing plants, including pilot plants

State[a]	Abbreviated name of facility	Location	Subsidiary arrangements in force
Democratic People's Republic of Korea	Radiochemical Laboratory	Bungang-Ri, Nyongbyon	—
Germany	WAK	Eggenstein-Leopoldshafen	x
India	PREFRE	Tarapur	x
Italy	EUREX	Saluggia	x
	ITREC-Trisaia	Rotondella	x
Japan	Tokai reprocessing plant	Tokai-Mura, Ibaraki-ken	x
In addition, the following R&D facilities and locations are associated with reprocessing technology:			
Indonesia	*RMI*	*Serpong*	—
Japan	*SCF*	*Tokai-Mura, Ibaraki-ken*	*x*
	JAERI Tokai R&D	*Tokai-Mura, Ibaraki-ken*	*x*
	PNC Tokai R&D	*Tokai-Mura, Ibaraki-ken*	*x*
	Sumitomi Met. Mining	*Tokai-Mura, Ibaraki-ken*	*x*

Enrichment plants, including pilot plants

State[a]	Abbreviated name of facility	Location	Subsidiary arrangements in force
Argentina	Pilcaniyeu enrichment plant	Pilcaniyeu	—
Brazil	Enrichment plant (first cascade)	Resende	—
	Enrichment laboratory	Ipero	—
Germany	UTA-1	Gronau	x
Japan	Uranium Enrichment Plant	Tomata-gun, Okayama-ken	x
	Rokkasho Enrichment Plant	Kamikita-gun, Aomori-ken	x
Netherlands	URENCO	Almelo	x
South Africa	Semi-commercial enrichment plant	Pelindaba	—
	MLIS Enrichment Plant	Valindaba	—
United Kingdom	URENCO E22	Capenhurst	x
	URENCO A3 plant	Capenhurst	—
In addition, the following R&D facilities and locations are associated with enrichment technology:			
Brazil	*Lab. for laser spectroscopy*	*San Jose dos Campos*	—
	UF_6 laboratory	*Belo Horizonte*	—
Germany	*Urenco*	*Jülich*	—
Japan	*Asahi Chemical Industry*	*Hyuga-shi, Miyazaki-ken*	*x*
	Hitachi laboratory	*Hitachi-shi, Ibaraki-ken*	*x*
	JAERI Tokai R&D	*Tokai-Mura, Ibaraki-ken*	*x*
	Nuclear Development Corp.	*Tokai-Mura, Ibaraki-ken*	*x*
	PNC Tokai R&D	*Tokai-Mura, Ibaraki-ken*	*x*
	Toshiba R&D Centre	*Kawasaki-shi, Kanagawa-ken*	*x*
Netherlands	*Urenco*	*Almelo*	*x*
	Ultra-centrifuge	*Almelo*	—

Separate storage facilities

State[a]	Abbreviated name of facility	Location	Subsidiary arrangements in force
Argentina	Central store	Ezeiza	—
	Central store	Constituyentes	—
	Nuclear material store	Constituyentes	—
Belgium	Belgoprocess	Dessel	x
	Elbel	Beveren	—
Brazil	Aramar stores (2 units)	Ipero	—
	UF_6 production facility	Sao Paulo	—
Bulgaria	Long term storage	Kozloduy	x
Canada	Nuclear material	Chalk River	x
	Spent fuel canister store	Chalk River	x
	Douglas Point dry storage	Tiverton	x
	Gentilly-1	Gentilly	x
	Spent fuel storage	Chalk River	x
	AECL Research	Pinawa	x
	PUFDSF	Pickering	—
Chile	BGMN	Santiago	—
Czech Republic	Storage Škoda	Bolevec	—
	HLW store	Řež	—
	ISFS Dukovany	Dukovany	—
Democratic People's Republic of Korea	Nuclear Fuel Storage	Bungang-Ri, Nyongbyon	—
Denmark	Risø Store	Roskilde	x
	Risø Waste	Roskilde	—
Finland	TVO-KPA store	Olkilouto	—
France	COGEMA UP2 & UP3	La Hague	x
Germany	Bundeslager	Wolfgang	—
	ANF UF6 Lager	Lingen	x
	KFA AVR BL	Jülich	—
	KFA AVR	Jülich	x
	BZA-Ahaus	Ahaus	—
	LSG Offset-Lager	Hanau	—
	NCS-Lagerhalle	Hanau	—
	Gamma Services	Radeberg	—
	Urananlage	Ellweiler	x
	Energiewerke Nord GmbH	Lubmin	x
	Transportbehälterlager	Gorleben	—
Hungary	Central radionuclide store	Budapest	x
Italy	Compes. deposito	Saluggia	x
	AGIP deposito	Bosco Marengo	x
	Essor Nuclear Plant	Ispra	—
	Essor Storage	Ispra	x
	Research Centre	Ispra	—
Japan	KUFFS	Kyoto	x
Kazakhstan	Ulbinski Thorium Storage	Kamenogorsk	—

Separate storage facilities (cont.)

State[a]	Abbreviated name of facility	Location	Subsidiary arrangements in force
Luxembourg	International Metals S.A.	Luxembourg-Dommeldange	x
Pakistan	Hawks Bay depot	Karachi	x
Portugal	Inst. de Armazenagem	Sacavem	x
Russian Federation	Mashinostroitel'nyi Zavod	Ehlektrostal	—
Slovakia	AFRS	Bohunice	x
South Africa	Waste Storage	Pelindaba	—
	Bulk storage facility	Pelindaba	—
	HEU storage vault	Pelindaba	—
	Radiation Hill pipe store	Pelindaba	—
Spain	CIEM.	Madrid	—
Sweden	Central long term storage	Oskarshamn	—
Switzerland	Diorit Storage	Würenlingen	x
Ukraine	Chernobyl Storage	Chernobyl	—
United Kingdom	Thorp R&S	Sellafield	x
	Special nuclear material store 9	Sellafield	x
United States of America	Pu storage vault	Hanford, WA	—
	Y-12 plant	Oak Ridge, TN	—
	Vault	Golden, CO	—

Other facilities

State[a]	Abbreviated name of facility	Location	Subsidiary arrangements in force
Argentina	Alpha facility	Constituyentes	—
	Triple altura laboratory	Ezeiza	—
	Experimental UO_2 plant	Cordoba	—
	Enriched uranium lab.	Ezeiza	—
	Fuel fabrication	Ezeiza	—
	Uranium powder fab. plant	Constituyentes	—
Australia	Research Lab.	Lucas Heights	x
Belgium	IRMM-Geel	Geel	x
	CEN-Labo	Mol	x
	CEN-Waste	Dessel	—
	I.R.E.	Fleurus	x
	CEN-lab. Pu	Mol	x
Brazil	Isotope laboratory	Sao Paulo	—
	Nuclear material lab.	Ipero	—
	Safeguards store	Sao Paulo	—
Chile	UMF	Santiago	—
Czech Republic	Nuclear Fuel Inst. (UJP)	Zbraslav	x
	Research Laboratories	Řež	x
Democratic People's Republic of Korea	Subcritical Assembly	Pyongyang	x
Germany	DESY	Hamburg	—
	KFA-heisse Zellen	Jülich	x
	KFK-heisse Zellen	Eggenstein-Leopoldshafen	x
	KFK/IHCH	Eggenstein-Leopoldshafen	x
	Siemens heisse Zellen	Karlstein	x
	KFA Lab.	Jülich	x
	Transuran	Eggenstein-Leopoldshafen	x
	VKT.UT + LAB	Rossendorf	x
	VKT. Tec. ZTR	Rossendorf	x
Hungary	Institute of Isotopes	Budapest	x
Indonesia	RMI	Serpong	—
Iran, Islamic Republic of	LWSCR	Esfahan	x
	GSCR	Esfahan	x
Italy	CNEN-LAB. PU.	Santa Maria di Galeria	x
Japan	JAERI-Oarai R&D	Higashi-gun, Ibaraki-ken	x
	JAERI-Tokai R&D	Tokai-Mura, Ibaraki-ken	x
	Kumatori R & D	Sennan-gun, Osaka	x
	Mitsui Iwakuni-Ohtake	Kuga-gun, Yamaguchi	x
	Mitsui Toatsu	Takai-shi, Osaka-fu	x
	NDC Fuel Hot Lab.	Tokai-Mura, Ibaraki-ken	x
	NDC fuel laboratories	Tokai-Mura, Ibaraki-ken	x
	NERL, University of Tokyo	Tokai-Mura, Ibaraki-ken	x
	NFD	Higashi-gun, Ibaraki-ken	x
	NFI Tokai-2	Tokai-Mura, Ibaraki-ken	x
	NRF Neutron Radiation Facility	Tsukuba-shi, Ibaraki-ken	x
	PNC FMF	Higashi-gun, Ibaraki-ken	x
	PNC IRAF	Higashi-gun, Ibaraki-ken	x
	PNC-Oarai R&D	Higashi-gun, Ibaraki-ken	x

Other facilities (cont.)

State[a]	Abbreviated name of facility	Location	Subsidiary arrangements in force
Japan (cont.)	PNC-Tokai R&D	Tokai-Mura, Ibaraki-ken	x
	SCF	Tokai-Mura, Ibaraki-ken	x
	Showa-Kawasaki	Kawasaki-shi, Kanagawa-ken	x
	Sumitomo-Chiba	Sodegaura-shi, Chiba-ken	x
	Uranium Material Laboratory	Higashi-gun, Ibaraki-ken	x
Korea, Republic of	PIEF	Daejeon	x
Netherlands	ECN & JRC	Petten	x
Norway	Research laboratories	Kjeller	x
Poland	Institute for nuclear chemistry and engineering	Warsaw	—
	Institute of Nuclear Research	Świerk	x
South Africa	Decommissioned pilot enrichment plant	Pelindaba	—
	Decontamination and waste recovery	Pelindaba	—
	Hot Cell Complex	Pelindaba	x
	NU and DU metals plant	Pelindaba	—
Sweden	Central storage	Studsvik	x
Switzerland	E.I.R.	Würenlingen	—
Turkey	Nuclear fuel pilot plant	Istanbul	x
Ukraine	Khmelnitski FF Storage	Neteshin	—
	KHFTI	Kharkov	—
	Rovno FF Storage	Kuznetsovsk	—
	South Ukraine Storage	Yuzhnoukrainsk	—
	Zaporozhe FF Storage	Energodar	—

Non-nuclear installations

State[a]	Abbreviated name of facility	Location	Subsidiary arrangements in force
Argentina	Heavy water storage	Buenos Aires	x
Cuba	Storage of equipment	Prov. Havana	—

[a] An entry in this column does not imply the expression of any opinion whatsoever on the part of the Secretariat concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

Note: The Agency was also applying safeguards in Taiwan, China, at six power reactors, six research reactors/critical assemblies, one uranium pilot conversion plant, two fuel fabrication plants and one research and development facility.

Locations in Iraq containing nuclear material which are under the responsibility of the IAEA Action Team under United Nations Security Council Resolution 687

Location C	In the vicinity of Al Tuwaitha

Additional safeguards support provided by States

States and organizations representing groups of States having formal support programmes	States having R&D contracts and test programmes
Argentina	Argentina
Australia	Austria
Belgium	Latvia
Canada	Pakistan
European Atomic Energy Community	Russian Federation
Finland	
France	
Germany	
Hungary	
Indonesia	
Japan	
Netherlands	
Russian Federation	
Sweden	
United Kingdom	
United States of America	

Main equipment and activities in support of safeguards

	1994	*1995*
Gamma ray measurement systems	**Total in inventory**	
Low resolution systems	52	74
High resolution systems	27	49
Portable multichannel analysers	118	163
Detectors	191	367
Neutron measurement systems		
Detection heads for active neutron measurements	21	23
Detection heads for passive neutron measurements	21	22
Neutron coincidence counting electronics	63	82
Spent fuel measurement systems		
Cerenkov glow viewing devices	58	75
Spent fuel measurement systems	70	88
Other measurement systems		
Physical properties devices	106	122
Optical surveillance systems		
Photo cameras	960	995
Video single camera systems	267	358
Video multiple camera systems	13	18
Video review stations	37	50
Seals		
In situ verifiable seals	417	598
Radiation monitoring systems	39	41
Activities		
Metal cap seals issued	16 249	21 878
Metal cap seals verified	14 176	16 476
Shipment of equipment and supplies	396	462
Hand-carried transport of equipment and supplies	426	378
Shipment of reference material and chemicals to facilities	163	129
Shipment of inspection samples, radioactive material standards and contaminated items to SAL[a]	190	194
Procurement actions	1913	2120

[a] SAL: Safeguards Analytical Laboratory.

Conventions negotiated and adopted under the auspices of the Agency and for which the Director General is the Depositary (status and relevant developments)

Agreement on the Privileges and Immunities of the IAEA (reproduced in document INFCIRC/9/Rev.1): During 1995, there was no change in the number of Parties to the Agreement. The number of Member States who have accepted the Agreement remains at 65.

Vienna Convention on Civil Liability for Nuclear Damage (reproduced in document INFCIRC/500): Entered into force on 12 November 1977. Now has 26 Parties as a result of accession by 2 States, and 11 signatories as a result of signature by 1 State.

Convention on the Physical Protection of Nuclear Material (reproduced in document INFCIRC/274/Rev.1): Entered into force on 8 February 1987. In 1995, one State acceded to the convention. By the end of the year there were 53 Parties.

Convention on Early Notification of a Nuclear Accident (reproduced in document INFCIRC/335): Entered into force on 27 October 1986. Was acceded to by one State, bringing the total number of Parties at the end of 1995 to 75.

Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (reproduced in document INF-CIRC/336): Entered into force on 26 February 1987. Was acceded to by one State. There were 71 Parties by the end of 1995.

Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (reproduced in document INFCIRC/402): Entered into force on 27 April 1992. During 1995, 3 States acceded to the Protocol, bringing the number of States Party to 20.

Extension of the African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Energy (AFRA) (reproduced in document INFCIRC/377/Add.6): Entered into force on 4 April 1995 upon expiry of the original agreement. It was accepted by ten States during 1995.

Agreement to Extend the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology, 1987 (RCA) (reproduced in document INFCIRC/167/Add.15): Entered into force on 11 June 1992. There was no change in its status during the year, leaving at 17 the total number of acceptances.

Convention on Nuclear Safety (reproduced in document INFCIRC/449): Was adopted on 17 June 1994. Article 31.1 provides that the Convention will enter into force on the 90th day after the date of deposit with the Depositary of the 22nd instrument of ratification, acceptance or approval, including the instruments of 17 States, each having at least one nuclear installation which has achieved criticality in a reactor core. During 1995, 13 States deposited instruments of ratification, acceptance or approval. This brings to 14 the total number of instruments deposited, and 62 signatories by the end of the year. A group of signatories and other interested States met in March and December to consult on the Rules of Procedure and Financial Regulations in preparation for the Preparatory Meeting of Contracting Parties, to be held pursuant to Article 20.1 of the Convention not later than six months after its entry into force.

Co-ordinated Research Programmes
(with year of start and completion)

Nuclear Power

Advanced reactor developments

Establishment of a thermophysical database for light and heavy water reactors	1990	1995
Acoustic signal processing for the detection of sodium boiling or sodium/water reactions in LMFRs	1989	1995
Intercomparison of LMFR seismic analysis codes	1991	1995
Validation of safety related physics calculations for low enriched high temperature gas cooled reactors	1990	1995
Design and evaluation of heat utilization systems for the high temperature engineering test reactor (HTTR)	1993	1997
Heat transport and afterheat removal for gas cooled reactors under accident conditions	1993	1997
Validation of predictive methods for fuel and fission product behaviour in gas cooled reactors	1993	1995
Thermohydraulic relationships for advanced water cooled reactors	1990	1994
Intercomparison of analysis methods for seismically isolated nuclear structures	1995	1999
Harmonization and validation of fast reactor thermomechanical and thermohydraulic codes and relations using experimental data	1995	1998
Potential of Th based fuel cycles to constrain Pu and to reduce long term waste toxicities	1995	1998
Case studies to assess and compare the potential role of nuclear power and other options in reducing emissions and residuals from electricity generation	1995	1997

Nuclear Fusion

Development of plasma heating and diagnostic systems in institutes in developing countries using small and middle scale devices	1992	1997
Development of software for numerical simulations and data processing in fusion energy research	1992	1995
Engineering, industrial and environmental applications of plasma physics and fusion technologies	1996	1998

Nuclear Fuel Cycle

Reactor fuel technology and performance

Examination and documentation methodology for water reactor fuel (ED-WARF-2)	1992	1995
Fuel modelling at extended burnup (FUMEX)	1993	1997
Stress corrosion cracking of zirconium alloy fuel claddings	1994	1997
High temperature on-line monitoring of water chemistry related to fuel behaviour and activity transport (WACOL)	1995	1999

Spent fuel management, technology and safety

Behaviour of spent fuel assemblies and storage equipment under long term storage conditions (BEFAST-III)	1991	1996
Irradiation enhanced degradation of materials in spent fuel storage facilities	1993	1997
Safety, environmental and non-proliferation aspects of the partitioning and transmutation of actinides and fission products	1994	1998

Radioactive Waste Management

Handling, treatment, conditioning and storage of radioactive wastes

Performance of high level waste forms and packages under repository conditions	1991	1997
Waste treatment and immobilization technologies involving inorganic sorbents	1991	1996
Treatment technologies for low and intermediate level wastes generated from nuclear applications	1991	1996

Radioactive waste disposal

Performance of engineered barrier materials in near surface disposal	1991	1995

Decontamination and decommissioning of nuclear installations

New methods and techniques for optimization of decontamination for maintenance and decommissioning	1994	1998

Radiological and environmental aspects of waste management

Modelling of the radiological impact of waste dumping in the Arctic seas	1993	1996
Site characterization techniques used in environmental restoration	1995	1999
Extrapolation of short term observations to time periods for isolation of long lived radionuclides	1995	2000
Safety assessment of near surface radioactive waste disposal facilities (NSARS)	1990	1995

Comparative Assessment of Nuclear Power and Other Energy Sources

Case studies to assess the potential role of nuclear power and other options in reducing emissions and residuals from electricity generation	1995	1997
Comparative health and environmental risks of nuclear and other energy systems using case studies	1989	1996

Food and Agriculture

Soil fertility, irrigation and crop production

Assessment of irrigation schedules of field crops to increase the effective use of water in irrigation projects	1990	1995
Optimizing N_2 fixation in tree crops	1990	1997

Enhancing soil fertility and crop production by better management of *Rhizobium*	1992	1996
Use of nuclear and related techniques for evaluating the agronomic effectiveness of phosphate fertilizers, in particular rock phosphate	1993	1998
Optimizing fertilizer applications under irrigated wheat to increase the efficient use of fertilizers and consequently reduce environmental pollution	1994	1999
Use of irradiated sewage sludge to increase soil fertility and crop yields, and to preserve the environment	1995	1999

Plant breeding and genetics

Induced mutations in connection with biotechnology for crop improvement in Latin America	1993	1998
Improvement of basic food crops in Africa through plant breeding, including the use of induced mutations	1989	1995
Induced mutations for sesame improvement	1993	1998
The application of DNA based marker mutations for improvement of cereals and other sexually reproduced crop species	1992	1997
Use of novel DNA fingerprinting techniques for the detection and characterization of genetic variation in vegetatively propagated crops	1992	1997
Induced mutations and other advanced technology for the production of crop mutants suitable for environmentally sustainable agriculture	1993	1998
In vitro techniques for the selection of radiation induced mutants adapted to adverse environmental conditions	1993	1998
Radioactively labelled DNA probes for crop improvement	1994	1999
Improvement of new and traditional industrial crops by induced mutations and related biotechnology	1994	1999
Cellular biology and biotechnology, including mutation techniques, for the creation of new useful banana genotypes	1994	1999

Animal production and health

Development of feed supplementation strategies for improving the productivity of dairy cattle on smallholder farms in Africa	1994	1998
Development of supplementation strategies for milk producing animals in tropical and subtropical environments through the use of nuclear and related techniques	1993	1998
Use of immunoassay methods for improved diagnosis of trypanosomiasis and monitoring tsetse and trypanosomiasis control programmes in Africa	1994	1999
Improving the diagnosis and control of foot and mouth disease in South East Asia using ELISA based technologies	1994	1999
The use of ELISA for epidemiology and control of foot and mouth disease and bovine brucellosis in Latin America	1994	1998
Improvement of ruminant livestock productivity in developing countries through the use of progesterone RIA to increase the efficiency and quality of artificial insemination services	1995	1999

Insect and pest control

Development of practices for area-wide tsetse eradication or control with emphasis on the SIT	1989	1995
Evaluation of population suppression by irradiated lepidoptera and their progeny	1992	1998
Development of female medfly attractant systems for trapping and sterility assessment	1993	1998
Medfly mating behaviour studies under field cage conditions	1993	1998
Automation in tsetse fly mass rearing for use in sterile insect technique programmes	1994	1999
Enhancement of the sterile insect technique through genetic transformation using nuclear techniques	1994	1999
A molecular and genetic approach to develop sexing strains for field application in fruit fly SIT programmes	1994	1999
Improved attractants for enhancing the efficiency of tsetse fly suppression operations and barrier systems used in tsetse control/eradication campaigns	1994	1999

Agrochemicals and residues

Adverse effects on flora and fauna from the use of organochlorine pesticides on the African continent	1990	1995
Development of procedures to stabilize acaricides in livestock dips and of simplified methods to measure their concentration using nuclear techniques	1992	1996
Use of isotopic tracers in studies of herbicide performance in grasses and sedges	1992	1997
Radionuclide transfer from air, soil and fresh water to the food chain of man in tropical and subtropical environments	1993	1997
The use of nuclear and immunochemical methods for pesticide analysis	1993	1998
Agroecological effects resulting from the use of persistent pesticides in Central America	1993	1997
Distribution, fate and effects of pesticides on biota in the tropical marine environment using radiolabelled tracers	1993	1997
Impact of long term pesticide usage on soil properties using radiotracer techniques	1994	1999

Food preservation

Irradiation as a quarantine treatment of mites, nematodes and insects other than fruit fly	1992	1997
Irradiation as a public health intervention measure to control food-borne diseases (cysticerosis/taeniasis and *Vibrio* infection) in Latin America and the Caribbean (under the co-sponsorship of PAHO)	1993	1998
Standardized methods to verify the absorbed dose of irradiated fresh and dried fruit and tree nuts in trade	1993	1998
Integration of irradiation in a system for reducing post-harvest food losses in Africa	1994	1999
Market development and trade in irradiated food in Asia	1994	1998
Development of shelf stable and convenience foods through irradiation processing	1995	2000

Human Health

Nuclear medicine

Nuclear investigations in cerebral function	1991	1995

Qualitative nuclear cardiology	1991	1995
Development of indigenous capability to conduct a screening programme for hepatitis in developing countries (RCA)	1992	1996
Certification of quality control and preventive maintenance of nuclear medical equipment (Asia and the Pacific)	1992	1996
Comparative evaluation of the efficacy and toxicity of intravenous ^{89}Sr and oral ^{32}P in the palliative treatment of painful skeletal metastases	1993	1996
Nuclear techniques for the diagnosis of bacterial and viral infections (Africa)	1993	1996
Biological discrimination of hormone sensitive and insensitive breast cancer tissue using radioimmunoassay of hormone receptors and growth factors	1994	1996
Certification of quality control and preventive maintenance of nuclear medical equipment (Latin America)	1994	1996
Diagnosis of Chagas' disease (Latin America)	1994	1997
Nuclear techniques for the diagnosis of blood borne infections (Asia and Pacific)	1994	1997
Standardization of ^{131}I treatment of hyperthyroidism with an intent to optimize radiation dose and treatment response	1995	1999
Development of indigenous capability of reagent production for hepatitis B in developing countries	1995	1997
Perinatal diagnosis using radionuclide labelled probes	1995	1997
Radioimmunoassay of prostate specific antigen for diagnosis and follow-up of prostate cancer	1995	1997
Validation of IBM-PC interfacing with gamma cameras and appropriate application software for data processing of clinical studies	1995	1997
Applied radiation biology and radiotherapy		
Comparative assessment of mutagenic and carcinogenic effects of low level radiation and toxic chemicals released from energy cycles	1992	1996
Radiation responsiveness criteria for human tumours as a determinant for therapeutic modality planning	1992	1998
Modern techniques in brachytherapy of cancer with special reference to the developing countries	1993	1998
Clinical application of radiosensitizers in cancer radiotherapy	1994	1999
Randomized clinical trial of radiotherapy combined with mitomycin C in the treatment of advanced head and neck tumours	1995	1999
Application of heavy charged particles in cancer radiotherapy	1995	1998
Quality assurance in radiotherapy for Latin America	1995	1998
Use of radiotherapy in advanced cancer	1995	1998
Dosimetry		
Development of quality control dosimetry techniques for particle beam radiation processing	1988	1995
Characterization and evaluation of high dose dosimetry techniques for quality assurance in radiation processing	1994	1999
Development of a quality assurance programme for Secondary Standard Dosimetry Laboratories	1995	1998

Development of a quality assurance programme for radiation therapy dosimetry in developing countries	1995	1998

Nutritional and health related environmental studies

Assessment of environmental exposure to mercury in selected human populations as studied by nuclear and other techniques	1990	1995
Isotope aided studies of the bioavailability of iron and zinc from human diets	1990	1995
Applied research on air pollution using nuclear related analytical techniques	1992	1997
Development and selection of analytical techniques and procedures for measuring accidentally released radionuclides in the environment	1992	1996
Application of stable isotope tracer methods to studies of amino acid, protein and energy metabolism in malnourished populations of developing countries	1993	1998
Comparative international studies of osteoporosis using isotope techniques	1994	1998
Development and application of isotopic techniques in studies of vitamin A nutrition	1995	1999
Applied research on air pollution using nuclear related analytical techniques in the Asia and Pacific region (RCA)	1995	1999
Ingestion and organ content of trace elements of importance in radiological protection (RCA)	1995	1999

Industry and Earth Sciences

Industrial applications

Irradiation treatment of water, waste water and sludge	1995	1998
Radiation processing to prepare biomaterials for applications in medicine	1995	1998
Modification of materials by ion treatment for industrial applications	1995	1998
Nuclear techniques for advanced ceramics and semiconductors	1992	1996
Application of nuclear techniques for environmental preservation in resource extraction and processing	1992	1996
Nuclear methods in the monitoring of wear and corrosion in industry	1992	1996
Nuclear techniques for the evaluation of healing pathways of pollutant damage in the environment	1992	1996
Stability and stabilization of polymers under irradiation	1993	1997

Development of water resources

Use of environmental isotopes in palaeoclimatology	1992	1995
Isotope aided studies of atmospheric carbon dioxide and other greenhouse gases in the atmosphere	1990	1994
Isotope techniques in lake dynamics investigations	1993	1996
Isotope techniques in water resources investigations in arid and semi-arid regions	1994	1997
Isotope techniques in groundwater pollution studies	1994	1997
Application of tracer techniques in the study of the Black Sea (jointly with IAEA-MEL)	1993	1996
Use of isotopes for analyses of flow and transport dynamics in groundwater systems	1995	1997

Isotope aided studies of atmospheric carbon dioxide and other greenhouse gases in the atmosphere — Phase II	1995	1998
Application of isotope techniques to study soil erosion and sedimentation rate in lakes and reservoirs	1995	1997

Physical and Chemical Sciences

Nuclear and atomic data for applications

Activation cross-sections for the generation of long lived radionuclides	1989	1995
Compilation and evaluation of fission product yield nuclear data	1991	1996
Plasma interaction induced erosion of fusion reactor materials	1991	1996
Improvement of measurements, theoretical computations and evaluations of neutron induced helium production cross-sections	1992	1996
Establishment of an international reference data library of nuclear activation cross-sections	1993	1997
Collection and evaluation of reference data on thermomechanical properties of fusion reactor plasma facing materials	1994	1996
Development of a reference input parameter library for nuclear model calculations of nuclear data	1994	1997
Measurement, calculation and evaluation of photon production data	1994	1998
Radiative cooling rates of fusion plasma impurities	1994	1997
Tritium retention in fusion reactor plasma facing components	1995	1998
Atomic and plasma–wall interaction data for fusion reactor plasma modelling	1995	1998
Development of a reference charged particle cross-section database for medical radioisotope production	1995	1998

Nuclear instrumentation

Development of computer based troubleshooting tools and instruments	1996	1998

Utilization of research reactors and particle accelerators

Application of PCs to enhance the operation and management of research reactors	1990	1995
Analysis of research reactor transients	1995	1998

Chemistry

Labelling, quality control and clinical evaluation of monoclonal antibodies for scintigraphy	1990	1996
Antibodies immobilized on magnetic particles for radioimmunoassay and immunoradiometric assay of hormones	1991	1995
Optimization of the production and quality control of radiotherapeutic radionuclides and radiopharmaceuticals	1992	1996
Design and evaluation of heat utilization systems for the high temperature engineering test reactor	1994	1998
Evaluation of bulk reagents for the production of $^{99}Tc^{m}$ radiopharmaceutical kits	1995	1998

Development of agents for imaging central neural systems receptors based on technetium-99m	1995	1998
Technetium-99m labelled peptides for the imaging of peripheral receptors	1995	1998

Radiation Safety

Occupational radiation protection

Intercomparison of in vivo counting systems using a reference Asian phantom	1995	1997
Reference Asian man project Phase II: Ingestion and organ content of trace elements of importance in radiation protection	1995	1997
Limitations of radioepidemiological assessments for stochastic radiation effects in relation to radiation protection	1994	1997
Radiation protection in diagnostic radiology in Asia and the Far East	1994	1997
Radiation protection in diagnostic radiology in eastern European countries	1993	1997

Radiation protection of the public and the environment

Radionuclide transfer to humans in tropical and subtropical environments	1994	1997

Safe transport of radioactive material

Accident severity at sea during the transport of radioactive material	1994	1997
Assessment of safety of uranium hexafluoride (UF_6) transport packages in fires	1992	1996
Development of relevant accident data for quantifying risks associated with the transport of radioactive materials	1994	1997

Safety of Nuclear Installations

Engineering safety issues of nuclear power plants

Benchmark study for seismic analysis and testing of WWER type nuclear power plants	1993	1996
Management of ageing of the concrete containment building	1992	1995
Management of ageing of in-containment instrumentation and control cables	1992	1995
Seismic data for the siting and site revalidation of nuclear facilities	1989	1996

Research reactor safety

Application of non-destructive testing and in-service inspection to research reactors	1995	1998

Nuclear safety assessment practices

Validation of accident and safety analysis methodology	1995	1998
Collection and classification of human reliability data for use in probabilistic safety assessments	1994	1997

Training courses, seminars and workshops in 1995
(with location)

Nuclear Power

National seminar on the systematic approach to personnel training (SAT) for the safe operation of nuclear power plants	China
Workshop on management responsibilities in the training and qualification of nuclear power plant personnel	Germany
Workshop on SAT implementation for operations and maintenance personnel	Hungary
Seminar on project organization	Islamic Republic of Iran
Interregional course on strengthening nuclear power project management	Republic of Korea
Seminar on SAT based personnel training for nuclear power plants	Ukraine
Interregional course on electricity demand forecasting for nuclear power planning (MAED)	USA
National course on technical and economic evaluation of bids for nuclear power plants	Indonesia
National course on the ENPEP package	Indonesia
Regional workshop on practical issues related to the use of the Agency's planning models with emphasis on the ENPEP package (Europe)	Poland
Regional workshop on energy, electricity and nuclear power planning with emphasis on the Agency's planning methodologies (West Asia)	Jordan
Regional workshop on effective strategies for nuclear power programmes in RCA countries (RCA)	Republic of Korea
Regional workshop on input information for energy, electricity and nuclear power (RCA) planning with emphasis on the WASP model	Philippines
Training on the FINPLAN computer model for financial analysis of power development programmes (Indonesia and Pakistan)	Headquarters
Regional course on bidding, bid evaluation, contracting and financing of nuclear power projects	Spain
Training course on ageing phenomena and diagnostics for WWER type reactors	Slovakia
Workshop on technology for nuclear power plant life management	Republic of Korea
Regional workshop on in-service inspection equipment	Hungary
Regional workshop on ultrasonic inspection of WWER primary circuit austenitic piping welds	Spain
Seminar on quality assurance	Slovenia
Workshop on quality assurance for nuclear power plants	Turkey
Workshop on quality assurance for top management	Islamic Republic of Iran
Seminar on nuclear power plant operational quality assurance	Finland
Interregional course on nuclear power plant control and instrumentation	Germany
Workshop on nuclear power plant experience with surveillance and diagnostic and information systems	Slovakia

Nuclear Fuel Cycle

Regional course on uranium mining: Operational, safety and environmental aspects (Middle East and Europe)	France
Group training course on uranium geology, exploration and environment	Canada
Regional course on design, quality control and future perspectives on WWER fuel (Middle East and Europe)	Russian Federation
Interregional course on interim storage of spent fuel from nuclear power plants	USA, Canada

Radioactive Waste Management

Management of spent radiation sources and other wastes from small nuclear applications	Philippines
Management of low level radioactive wastes from hospitals and other nuclear applications	South Africa
Regional course (AFRA-1) on adoption and harmonization of safety regulations in radioactive waste management	Ghana
Seminar on requirements for the safe management of radioactive wastes	Headquarters
Radioactive waste management: An integrated systems approach	Spain

Food and Agriculture

Soil fertility, irrigation and crop production

Regional course on the use of isotopes and radiation techniques in studies of soil–plant relationships with emphasis on crop production on acid soils	Thailand
Interregional course on the use of isotopes and radiation techniques in studies of soil–plant relationships with emphasis on better nutrient utilization to improve crop production	Seibersdorf

Plant breeding and genetics

Interregional course on advances in plant mutation techniques	Seibersdorf
Regional for course for Latin America on mutation and in vitro techniques for crop improvement	Venezuela
Regional workshop on the organization of multi-location trials	Brazil
National workshop on biotechnology in connection with mutation techniques for food and cash crop improvement	Chile
Regional workshop on mutation breeding for stress tolerance	United Republic of Tanzania

Animal production and health

Immunoassay based techniques for rinderpest diagnosis	Mali
Use of immunoassay and related techniques for studies on animal production in Africa	Sudan
Rinderpest surveillance in West Asia	Syrian Arab Rpublic
Monitoring of tsetse and trypanosomiasis control programmes	Kenya
Improving the productivity of ruminant livestock through "on-farm" assessment of nutrition–reproduction interactions	Headquarters

Diagnosis of tick-borne diseases using immunoassay methods	Kenya
Use of immunoassay and molecular methods for animal disease diagnosis and control	Morocco

Insect and pest control

FAO/IAEA regional course on the sterile insect technique and F-1 sterility for control or eradication of noxious insects in Southeast Asia	Japan, Philippines
FAO/IAEA regional course on area-wide methods of tsetse and trypanosomiasis management	United Republic of Tanzania
FAO/IAEA seminar for Africa on animal trypanosomiasis: Vector and disease control using nuclear techniques	United Republic of Tanzania

Food preservation

FAO/IAEA workshop on dosimetry techniques for process control in food irradiation	South Africa

Human Health

Nuclear medicine

Interregional course on nuclear medicine	Germany
Regional course on paediatric nuclear medicine	India
Regional course on medical scintigraphy	Cuba
Regional course on nuclear medicine for junior physicians	Egypt
Regional course on production methods for radioimmunoassay reagents	Zimbabwe
Regional course on methodology, organization and operation of neonatal hypothyroidism screening programmes	Tunisia
Regional course on advanced methods of local reagent production for radioimmunoassay for hepatitis B	Thailand
Workshop on detection of markers for hepatitis C by radioimmunoassay	Malaysia
Interregional course on in vitro microanalytical methods in nuclear medicine	Thailand
Workshop on methodological aspects of hepatitis B diagnosis	Mexico
Workshop on radioimmunoassay methodology, quality control and data processing	Jordan
Workshop on methodological aspects of neonatal screening	United Arab Emirates
National course for nuclear medicine physicians and technologists	China
National course for nuclear medicine physicians and physicists	Egypt
Regional workshop on protection of nuclear instruments	Philippines
Regional workshop on maintenance and quality control of gamma camera/computer systems	Colombia
IAEA–ALASBIMN pre-congress course on quality control of nuclear medicine imaging	Brazil
IAEA–ALASBIMN post-congress course on image processing in nuclear medicine	Brazil
Regional workshop on upgrading analog gamma cameras	Ghana
National workshop on quality control of SPECT systems	Brazil, Argentina

National workshop on quality control of multi-head SPECT systems	Republic of Korea
Subregional workshop on use of portable image processing software (PIP)	Thailand

Applied radiation biology and radiotherapy

Regional workshop on radiotherapy and its applications (ARCAL)	Panama
Regional workshop on dissemination of information on procedures for production and radiation sterilization of tissue grafts (RCA)	Singapore
Regional course on current techniques and quality assurance in clinical radiotherapy (AFRA)	Nigeria
Regional course on radiation therapy in the management of cancer of the cervix (AFRA)	Morocco

Dosimetry

Meeting on quality assurance in radiotherapy. National programmes: Design, harmonization and structures	Headquarters
Regional seminar on radiotherapy dosimetry: Radiation dose from prescription to delivery	Thailand
Regional course on modern techniques and dosimetry in brachytherapy of malignant neoplasia	Mexico

Nutritional and health related environmental studies

Course on organochlorines	Peru, Ukraine
Course on gas chromatography–mass spectrometry	Bermuda
Course on organochlorines and petroleum hydrocarbons	Russian Federation
Course on trace metals and atomic absorption spectroscopy	Ukraine, Morocco
Sampling, sample preparation and data evaluation for multi-element and radionuclide analysis by nuclear and instrumental methods (regional, Latin America)	Chile
Nuclear analytical techniques in environmental research and monitoring (regional RCA, Asia and the Pacific)	Singapore
Nuclear analytical techniques applied to environmental pollution studies and monitoring (regional, Europe and the Middle East)	Germany

Industry and Earth Sciences

Fifth Group Fellowship training course in isotope hydrology	Headquarters
Regional course on the use of nuclear and related techniques for the study of leakage in dams and reservoirs	Venezuela
Regional workshop on the use of tracer technology to study dispersion of effluents in groundwater	Indonesia
Regional course on nuclear techniques in soil erosion, sediment transport and related environmental studies	Australia
Regional course on analytical techniques for water chemistry	Senegal
Regional course on advanced applications of radiation technology	Japan

Regional course on applications of radiation technology for decontamination of liquid wastes	Japan
Regional workshop on safe operation of radiation facilities	Japan
Regional seminar on biomedical applications of radiation technology	Venezuela
Regional course on radiation sterilization and process validation	Argentina
Regional course on the use of nuclear techniques for water management and protection of the environment	Guatemala
Regional course on the use of tracers in the mineral and food industries	Cuba
Regional course on application of non-destructive testing to rail, road, pipeline and other transport systems	South Africa
Regional workshop on non-destructive testing technology used in power stations	China
Regional workshop and seminar on fabrication and evaluation of non-destructive testing test pieces	Malaysia

Physical and Chemical Sciences

Advanced interregional course on nuclear electronics	China
Interregional course on experimental nuclear spectroscopy	Thailand
National course on interfacing	Sudan
National course on nuclear spectroscopy	El Salvador
National course on applications of personal computers in applied nuclear science	El Salvador
National course on the repair and maintenance of nuclear instruments	Myanmar
National course on the basics of nuclear electronics	Paraguay
Regional workshop on the testing and calibration of nuclear instruments for radiation monitoring (ARCAL 10)	Mexico
Regional workshop on the applications of personal computers in nuclear laboratories (ARCAL 19)	Uruguay
Regional workshop on the maintenance, testing and calibration of X ray equipment used in medicine (ARCAL 19)	Peru
Regional course on personal computer interfacing and microprocessor applications	Egypt
Regional course on the protection of nuclear instruments	Ghana
Regional workshop (AFRA) on neutronics and shielding calculations	Ghana
Regional workshop (AFRA) on thermal hydraulics and transient calculations for research reactors	South Africa
Regional course on synthesis of modern radiopharmaceuticals	Thailand
Regional course on hospital radiopharmacy	Portugal
Regional course on radiopharmaceutical kit technology	Brazil
Regional course on labelling and quality control of blood cells and biomolecules	Chile
Regional workshop on quality assurance in the analysis of environmental samples	Venezuela
Regional workshop on certification of analytical laboratories	Chile

Regional workshop on the development of methodologies for the evaluation of analytical data	Uruguay
Regional workshop on quality assurance in chemical measurements	Uruguay

Radiation Safety

Interregional post-graduate educational course on radiation protection	USA
Interregional course on the management of radiological accidents involving radiation sources	Brazil
Interregional course on the physical protection of nuclear facilities and materials	USA
Regional post-graduate educational course on radiation protection and nuclear safety	Argentina
Regional course on system of notification, registration, licensing and control of radiation sources and installations in East Asia and the Pacific (RCA)	Indonesia
Regional seminar for Asia and the Pacific on education and training in radiation protection and nuclear safety	Australia
Regional course on practical tools for accident assessment and consequence projection during radiological accidents	Slovenia
Regional course on the safe transport of radioactive material	France
Regional course on the system of notification, registration, licensing and control of radiation sources and installations	Islamic Republic of Iran, Madagascar
Regional workshop on radiation protection infrastructure	Lebanon
Regional workshop on radiation protection, waste management and remedial actions in the mining and milling of radioactive ores	Kazakhstan
Seminar on advancements in the implementation of the new Basic Safety Standards	Headquarters
Subregional workshop on the safe transport of radioactive material	Panama

Safety of Nuclear Installations

Interregional course on assessment techniques for the operational safety of nuclear power plants	USA
Interregional course on fire safety in nuclear power plants	India
Interregional course on safety in the operation of research reactors	USA, Canada
Regional workshop on commissioning licensing	Slovakia
Regional workshop on regulatory information to the public	Finland
Regional workshop on safety culture	Headquarters
Regional course on assessment and upgrading of nuclear power plants in relation to external events	Turkey
Regional course on a general approach to nuclear safety (principles and fundamentals)	Finland
Regional course on regulatory control of nuclear power plants	Slovakia

Regional course on safety and reliability improvements through optimized maintenance of nuclear power plants	China

Safeguards

Training course on State Systems of Accounting and Control (SSAC)	USA, Japan
Course for Chilean SSAC personnel and operators	Chile
Course on SSAC for Romanian State personnel	Romania

Security of Material

Course physical protection of nuclear facilities and materials	Czech Republic

Direction and Support

Advanced seminar for nuclear lawyers and regulators from eastern Europe and CIS countries	Czech Republic
Regional workshop on INIS (RCA)	India
Fifth group fellowship training course in INIS human resources development	Russian Federation
INIS workshop	Headquarters
VIC Library workshop for Permanent Mission staff on United Nations system documentation	Headquarters

Publications issued in 1995
(with series and number)

Nuclear Power

The nuclear power option	Proceedings Series
Plasma physics and controlled nuclear fusion research 1994	Proceedings Series
Energy, electricity and nuclear power estimates for the period up to 2015	Reference Data Series No. 1
Nuclear power reactors in the world	Reference Data Series No.2
Nuclear power, nuclear fuel cycle and waste management: Status and trends 1995	IAEA Yearbook 1995, Part C
Operating experience with nuclear power reactors in Member States	Annual publication
Energy from inertial fusion	Special publication
Response of fuel, fuel elements and gas cooled reactor cores under accidental air or water ingress conditions	IAEA-TECDOC-784
Status of liquid metal fast reactor development	IAEA-TECDOC-791
Intercomparison of liquid metal fast reactors. Validation of seismic analysis codes using reactor core experiments	IAEA-TECDOC-798
Computerization of operation and maintenance for nuclear power plants	IAEA-TECDOC-808
Control room systems design for nuclear power plants	IAEA-TECDOC-812
In-core fuel management code package validation for PWRs	IAEA-TECDOC-815
In-core fuel management: Reloading techniques	IAEA-TECDOC-816
Influence of low dose irradiation on the design criteria of fixed internals in fast reactors	IAEA-TECDOC-817
Earthquakes: Isolation, energy dissipation and control of vibrations of structures for nuclear and industrial facilities and buildings	IAEA-TECDOC-819
Intercomparison of liquid metal fast reactor seismic analysis codes. Vol. 2: Verifications and improvements of reactor core seismic analysis codes using core mock-up experiments	IAEA-TECDOC-829
In-core fuel management code package validation for WWERs	IAEA-TECDOC-847
ITER Council proceedings: 1994	ITER/EDA/DS/06
In-core fuel management code package validation for BWRs	IAEA-TECDOC-849
Energy and nuclear power planning study for Romania	IAEA-TECDOC-820
Wien Automatic System Planning (WASP) Package: A computer code for power generating system expansion planning. Version WASP-III Plus. User's Manual, Vols 1 and 2	Computer Manual Series No. 8

Nuclear Fuel Cycle

Safety and engineering aspects of spent fuel storage	Proceedings Series
Design of spent fuel interim storage facilities	Safety Series No. 116

Operation of spent fuel storage facilities	Safety Series No. 117
Safety assessment for spent fuel storage facilities	Safety Series No. 118
The Nuclear Fuel Cycle Information System. A directory of nuclear fuel cycle facilities. 1995 edition	Annual publication
Options, experience and trends in spent nuclear fuel management	Technical Reports Series No. 378
World map of uranium deposits	Special publication
Spatial data integration for mineral exploration, resources assessment and environmental studies: A guidebook	IAEA-TECDOC-782
Safety and environmental aspects of partitioning and transmutation of actinides and fission products	IAEA-TECDOC-783
Experience with spent fuel storage at research and test reactors	IAEA-TECDOC-786
Grain size determination in zirconium alloys	IAEA-TECDOC-794
Advances in control assembly materials for water reactors	IAEA-TECDOC-813
Recent developments in post-irradiation examination techniques for water reactor fuel	IAEA-TECDOC-822
Recent developments in uranium resources and supply	IAEA-TECDOC-823
Planning and management of uranium mine and mill closures	IAEA-TECDOC-824
Application of uranium exploration data and techniques in environmental studies	IAEA-TECDOC-827
Strategies for the back end of the nuclear fuel cycle	IAEA-TECDOC-839
Unconventional options for plutonium disposition	IAEA-TECDOC-840
Remote technology related to the handling, storage and disposal of spent fuel	IAEA-TECDOC-842
Characteristics and use of urania–gadolinia fuels	IAEA-TECDOC-844

Radioactive Waste Management

Principles of radioactive waste management	Safety Series No. 111-F
Establishing a national system for radioactive waste management	Safety Series No. 111-S-1
Safe enclosure of shutdown nuclear installations	Technical Reports Series No. 375
Quality assurance for radioactive waste packages	Technical Reports Series No. 376
Minimization of radioactive waste from nuclear power plants and the back end of the nuclear fuel cycle	Technical Reports Series No. 377
International co-operation on nuclear waste management in the Russian Federation	Special publication
Preparation of safety analysis reports (SARS) for near surface radioactive waste disposal facilities	IAEA-TECDOC-789
Validation of models using Chernobyl fallout data from the Central Bohemia region of the Czech Republic. First report of the VAMP multiple pathways assessment working group	IAEA-TECDOC-795
Methods to identify and located spent radiation sources	IAEA-TECDOC-804
Reference design for a centralized spent sealed sources facility	IAEA-TECDOC-806

Experience in the application of exemption principles	IAEA-TECDOC-807
Sources of radioactivity in the marine environment and their relative contributions to overall dose assessment from marine radioactivity (MARDOS)	IAEA-TECDOC-838
A directory of information resources on radioactive waste management, decontamination and decommissioning, and environmental restoration	IAEA-TECDOC-841
Safety assessment of near surface radioactive waste disposal facilities	IAEA-TECDOC-846
Radioactive waste management practices and issues in developing countries	IAEA-TECDOC 851
Requirements for the safe management of radioactive waste	IAEA-TECDOC-853
Waste management research abstracts, No. WMRA/22	

Comparative Assessment of Nuclear Power and Other Energy Sources

The DECADES project: Outline and general overview	DECADES Project Document No. 1
Guidelines for comparative assessment of the environmental impacts of wastes from electricity generation systems	IAEA-TECDOC-787
Nuclear power: An overview in the context of alleviating greenhouse gas emissions	IAEA-TECDOC-793

Food and Agriculture

Nuclear techniques in soil–plant studies for sustainable agriculture and environmental preservation	Proceedings Series
Induced mutations and molecular techniques for crop improvement	Proceedings Series
EASTMED: A proposal for medfly control or eradication with the sterile insect technique	Special publication
Nuclear methods in soil–plant aspects of sustainable agriculture	IAEA-TECDOC-785
In vitro mutation breeding of bananas and plantains	IAEA-TECDOC-800
Improvement of root and tuber crops in tropical countries of Asia by induced mutations	IAEA-TECDOC-809
Management strategies to utilize salt affected soils	IAEA-TECDOC-814
Isotope aided studies of pesticide residues during food processing	IAEA-TECDOC-818
Economic evaluation of damage caused by, and methods of control of, the Mediterranean fruit fly in the Maghreb	IAEA-TECDOC-830
Shelf-stable foods through irradiation processing	IAEA-TECDOC-843
Tanzanian tsetse brief	Special Newsletter No. 3

Human Health

Calibration of dosimeters used in radiotherapy	Technical Reports Series No. 374
Survey of reference materials volume 1: Biological and environmental reference materials for trace elements, nuclides and microcontaminants	IAEA-TECDOC-854
SSDL Newsletter No. 33	Newsletter

Industry and Earth Sciences

Isotope and geochemical techniques applied to geothermal investigations	IAEA-TECDOC-788
Advanced radiation chemistry research: Current status	IAEA-TECDOC-834
Use of neutron beams for low and medium flux research reactors: R&D programmes in materials science	IAEA-TECDOC-836
Use of neutron beams for low and medium flux research reactors: Radiography and materials characterization	IAEA-TECDOC-837
Alternative technologies for $^{99}Tc^{m}$ generators	IAEA-TECDOC-852

Physical and Chemical Sciences

CINDA 95: Index to literature and computer files of microscopic neutron data	Annual publication
Nuclear research reactors in the world, December 1995	Reference Data Series No. 3
Atomic and plasma–material interaction data for fusion, Vol. 6	Miscellaneous publication
Directory of nuclear research reactors	Special publication
Atomic and molecular data for radiotherapy and radiation research	IAEA- TECDOC-799
Production of $^{99}Tc^{m}$ radiopharmaceuticals for brain, heart and kidney imaging	IAEA-TECDOC-805
Reference and intercomparison materials for stable isotopes	IAEA-TECDOC-825
Use of nuclear techniques to study soil erosion and siltation	IAEA-TECDOC-828
International Centre for Theoretical Physics: Scientific activities in 1994	IAEA-TECDOC-833
Nuclear data newsletter No. 21	Newsletter
On-line nuclear data service: A user's manual	IAEA-NDS-150
Co-ordination of the international network of nuclear structure and decay data evaluators	INDC(NDS)-307
Co-ordination of the nuclear reaction data centres	INDC(NDS)-308
Radiative losses and electron cooling rates of hydrogen, helium, carbon and oxygen	INDC(NDS)-309
Particle interchange reactions involving plasma impurity ions and H_2, D_2 and HD	INDC(NDS)-310
Improved evaluations and integral data testing for FENDL	INDC(NDS)-312
Establishment of an international reference data library of nuclear activation cross-sections	INDC(NDS)-320
Development of a reference input parameter library for nuclear model calculations of nuclear data	INDC(NDS)-321
Particle impact induced electron ejection from surfaces	INDC(NDS)-322
Improvement of measurements, theoretical computations and evaluations of neutron induced helium production cross-sections	INDC(NDS)-323
The nuclear data centres network	INDC(NDS)-324
8th meeting of the IFRC subcommittee on atomic and molecular data for fusion	INDC(NDS)-325

Collection and evaluation of reference thermomechanical properties of fusion reactor plasma facing materials	INDC(NDS)-326
Radiative cooling rates of fusion plasma impurities	INDC(NDS)-
Development of an international nuclear decay data and cross-section database	INDC(NDS)-328
Measurement, calculation and evaluation of photon production data	INDC(NDS)-330
Atomic, molecular and particle–surface interaction data for diverter physics studies	INDC(NDS)-331
Analytical representation of electron impact excitation cross-sections of vibrationally excited H_2 and D_2 molecules	INDC(NDS)-333
Report of the IAEA Nuclear Data Section to the International Nuclear Data Committee	INDC(NDS)-336
A study into the reliability of collapsing SAND-II 640 multigroup data into VITAMIN-J 175 multigroup cross-section	INDC(NDS)-337
Activation cross-sections for the generation of long-lived radionuclides of importance in fusion reactor technology	INDC(NDS)-340
Technical aspects of the co-operation of nuclear reaction data centres	INDC(NDS)-343

Radiation Safety

International basic safety standards for protection against ionizing radiation and for the safety of radiation sources	Safety Series No. 115-I
Practical radiation technical manual: Workplace monitoring for radiation and contamination	IAEA-PRTM-1
Practical radiation technical manual: Personal monitoring	IAEA-PRTM-2
Radiation doses in diagnostic radiology and methods for dose reduction	IAEA-TECDOC-796
Developments in the transport of radioactive waste	IAEA-TECDOC-802
Directory of national competent authorities' approval certificates for package design, special form material and shipment of radioactive material. 1995 edition	IAEA-TECDOC-826
The PACKTRAM database on national competent authorities' approval certificates for package, design, special form material and shipment of radioactive material	Computer Manual Series No. 7
National competent authorities responsible for approvals and authorization in respect of the transport of radioactive material. List No. 26	IAEA-TECDOC-826
Standard syllabus of post-graduate educational courses in radiation protection	IAEA-SYL-01

Safety of Nuclear Installations

Treatment of external hazards in PSA for nuclear power plants	Safety Series No. 50-P-7
Procedures for conducting probabilistic safety assessment of nuclear power plants (level 2)	Safety Series No. 50-P-8
Evaluation of fire hazard analyses for nuclear power plants	Safety Series No. 50-P-9
A common basis for judging the safety of reactors built to earlier standards	INSAG-8

Potential exposure in nuclear reactor safety	INSAG-9
Nuclear safety review 1995	IAEA Yearbook, Part D
Safety assessment of computerized control and protection systems	IAEA-TECDOC-780
Reliability of computerized safety systems at nuclear power plants	IAEA-TECDOC-790
Management of research reactor ageing	IAEA-TECDOC-792
OSART mission highlights 1991–1992	IAEA-TECDOC-797
Development of safety principles for the design of future nuclear power plants	IAEA-TECDOC-801
Strength analysis of the bubbler condenser structure of WWER-440 Model 213 nuclear power plants	IAEA-TECDOC-803
Experimental design verification of WWER-440 model 213 nuclear power plants: Reference plant: Bohunice V2 (Slovakia)	IAEA-TECDOC-810
Experience from operation of WWER-440 model 213 nuclear power plants: Reference plant: Bohunice V2 (Slovakia)	IAEA-TECDOC-811
Experience with strengthening safety culture in nuclear power plants	IAEA-TECDOC-821
Policy for setting and assessing regulatory safety goals. Peer discussions on regulatory practices	IAEA-TECDOC-831
IPERS guidelines for the international peer review service. Second edition	IAEA-TECDOC-832
RBMK shutdown systems	IAEA-EBP-RBMK-01
Multiple pressure tube rupture in channel type reactors	IAEA-EBP-RBMK-02
Safety assessment of proposed modifications for the Ignalina nuclear power plant	IAEA-EBP-RBMK-03
PSAPACK 42. A code for probabilistic safety assessment level 1. User's manual for the mainframe computer version	Computer Manual Series No. 6

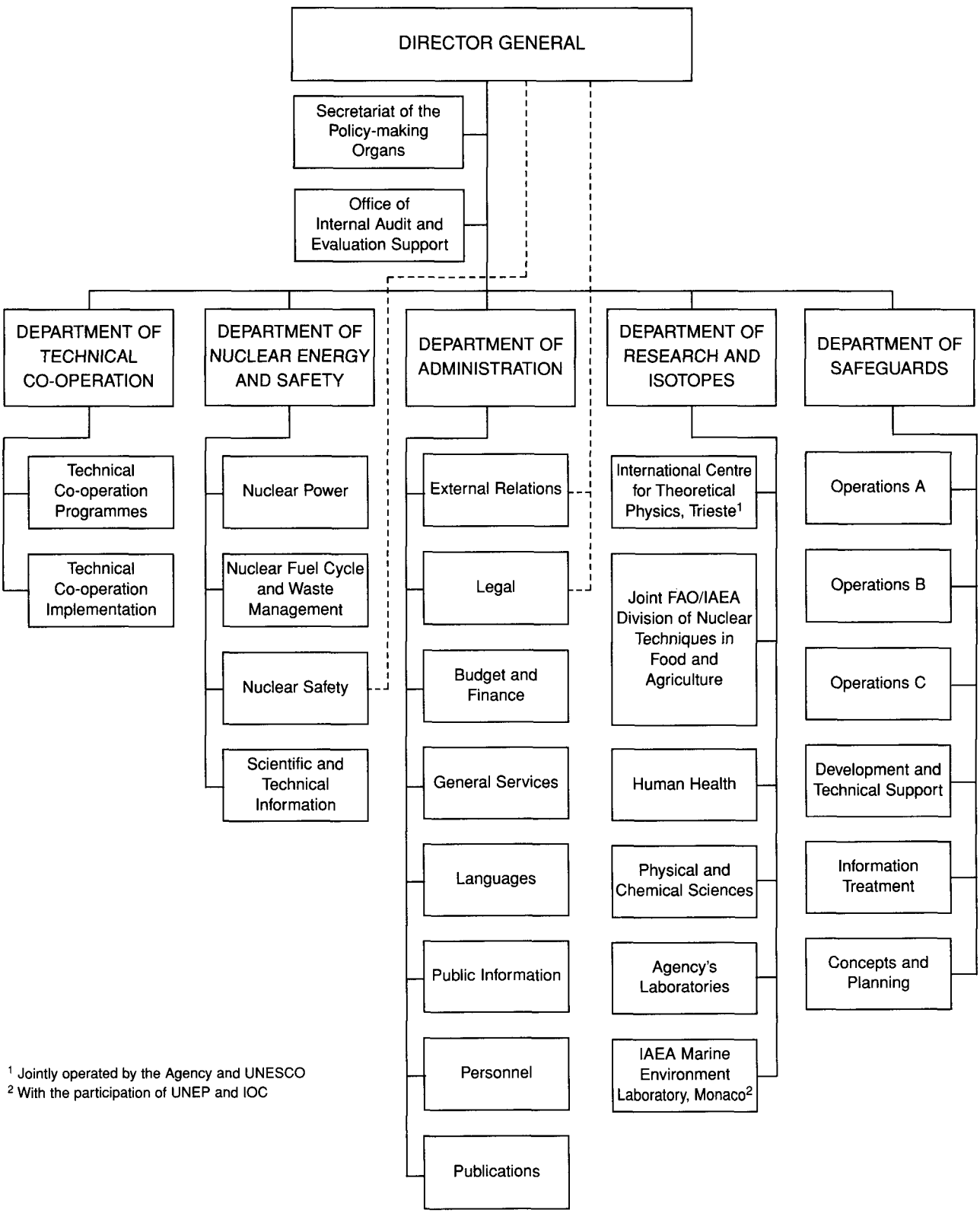
ABBREVIATIONS

ABACC	Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials
ARCAL	Regional Co-operative Arrangements for the Promotion of Nuclear Science and Technology in Latin America
BWR	Boiling water reactor
CANDU	Canadian deuterium-uranium (reactor)
CRP	Co-ordinated research programme
EC	European Commission
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
EU	European Union
EURATOM	European Atomic Energy Community
FAO	Food and Agriculture Organization of the United Nations
FORATOM	Forum atomique européen
HTGR	High temperature gas cooled reactor
HWR	Heavy water reactor
IAEA-MEL	IAEA Marine Environment Laboratory
ICAO	International Civil Aviation Organization
ICRP	International Commission on Radiological Protection
ICRU	International Commission on Radiation Units and Measurements
ICTP	International Centre for Theoretical Physics
IEA	International Energy Agency (OECD)
IIASA	International Institute for Applied Systems Analysis
ILO	International Labour Organisation
IMO	International Maritime Organization
INDC	International Nuclear Data Committee
INIS	International Nuclear Information System
ISO	International Organization for Standardization
LWGR	Light water graphite moderated reactor
LWR	Light water reactor
NDA	Non-destructive assay
NEA	Nuclear Energy Agency of the OECD
NUSS	The Agency's programme on nuclear safety standards for nuclear power plants
OAU	Organization for African Unity
OECD	Organisation for Economic Co-operation and Development
OLADE	Organización Latinoamericana de Energía
OPANAL	Organismo para la Proscripción de las Armas Nucleares en América Latina y el Caribe
OPEC	Organization of Petroleum Exporting Countries
PAHO	Pan American Health Organization/WHO
PHWR	Pressurized heavy water reactor
PWR	Pressurized water reactor
RBMK:	Light boiling water cooled graphite moderated pressure tube reactor (former USSR)
RCA	Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology
SQ	Significant quantity
UNCED	United Nations Conference on Environment and Development (1992)

UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNIPEDE	International Union of Producers and Distributors of Electrical Energy
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UNU	United Nations University
VIC	Vienna International Centre
WANO	World Association of Nuclear Operators
WEC	World Energy Council
WHO	World Health Organization
WMO	World Meteorological Organization
WTO	World Trade Organization
WWER	Water cooled and moderated energy reactor (former USSR)

ORGANIZATIONAL CHART

(as of 31 December 1995)



[1] Jointly operated by the Agency and UNESCO
[2] With the participation of UNEP and IOC