

THE YEAR IN REVIEW

In 1998, there were a number of developments in the international environment relating to the Agency's overall programme: the international dimension of nuclear safety became increasingly recognized; the need for sustainable development continued to be a priority; the requirements for electricity generation without the emission of environmental pollutants, and especially the emission of greenhouse gases, grew in urgency; and the importance of worldwide moves towards a strengthened non-proliferation regime was heightened. Against this background, the Agency set in motion a re-examination and redirection of its functioning in order better to meet the needs and interests of its Member States.

During the year, the Agency operated on a regular budget of \$226 million and also used slightly more than \$30.1 million in extrabudgetary funds for important activities in support of programmes. The target for contributions to the Technical Co-operation Fund for 1998 was set at \$71.5 million, of which \$53.4 million was pledged by Member States.

At the end of 1998, there were 2133 staff members of the Secretariat — 847 in the Professional and higher categories and 1286 in the General Service category. These figures represent 1676 regular, 278 temporary assistance and 179 extrabudgetary staff. Ninety-five nationalities were represented among the 684 staff members in posts subject to geographical distribution.

This review highlights some of the achievements of the Agency in 1998 against the background of worldwide developments.

Nuclear technology and energy for sustainable development

Nuclear technology

The importance of water

Water — its quantity and quality — continued to be a critical global issue. One particular expression of this

concern was the growing interest expressed by Member States in nuclear technology for desalination:

- A joint pre-project study by Morocco and China was completed in October with the assistance of the Agency under a technical co-operation project. Morocco selected a 10 MW(th) nuclear reactor from China for a desalination plant to be built in Tan-Tan. A co-operation agreement was signed between the two Governments in December.
- The Republic of Korea is about to complete its conceptual design of the 100 MW(e) System Integrated Modular Advanced Reactor. It is planned to couple the reactor to a desalination unit.
- In India, an existing PHWR at Kalpakkam will be coupled to a desalination unit. Civil work for the desalination system has already been started, with commissioning foreseen in 2001.
- In Argentina, a small 25 MW(e) reactor is being designed for coupling to a desalination system.

Another sign of heightened interest in the problem of water was the decision by the United Nations to declare 1998 the 'International Year of the Ocean'. The overall objective was to focus the attention of the public, governments and decision makers on the importance of the oceans and the marine environment as resources for sustainable development in the light of the increasing threats of pollution, population pressure, excessive fishing, coastal zone degradation and climate variability. The Agency and other international organizations involved in ocean related studies contributed jointly to this endeavour. The interagency co-operation programmes included a contribution to EXPO '98 in Lisbon, and joint conferences, co-ordination meetings and regional assessments. The most important event in which the Agency played a leading role was a symposium on marine pollution, organized in co-operation with the IOC of UNESCO, UNEP, IMO and the Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée, held in Monaco in October. The symposium was a timely opportunity for scientists to share the latest knowledge on the sources, behaviour and impact of marine contaminants in the world's oceans. During the same week the new premises of the Agency's Marine Environment Laboratory were inaugurated.

Greater efforts were made to initiate joint programmes and collaboration with other United Nations agencies in the area of water resources development and management. For example, a Memorandum of Understanding was signed between the Agency and WMO to further enhance collaboration in operating

the Global Network for Isotopes in Precipitation. The joint efforts are aimed at a wider use of the isotope data.

The Agency's work in isotope hydrology in Africa was given special recognition by being included in a United Nations system-wide initiative (see Box 1). The Agency

BOX 1

Water resources in Africa

A number of countries in Africa are currently facing a crucial shortage of freshwater that threatens public health and impedes social and economic development. This situation has prompted the United Nations to include water among the set of priorities of the 'System-wide Initiative on Africa', with the aim of assuring sustainable use of and equitable access to freshwater. The Agency contributes to this initiative with two large technical co-operation Model Projects aimed at solving specific practical problems related to the assessment and management of water resources using isotope techniques in combination with other hydrological studies. The first project started in 1995 and involves nine countries in northern Africa: Algeria, Egypt, Ethiopia, Mali, Morocco, Niger, Nigeria, Senegal and Sudan. The second Model Project started this year with seven countries from southern and eastern Africa, namely Kenya, Madagascar, Namibia, South Africa, the United Republic of Tanzania, Uganda and Zimbabwe. In 1998 the first phase of the northern Africa project was completed.

Senegal, in common with other Sahel countries south of the Sahara desert, has faced a significant decline in rainfall over the last four decades, coupled with increasing demands on its water resources, principally groundwater. The metropolitan area of Dakar, with a population of more than 1.5 million and 70% of its water drawn from aquifers located in the coastal zone, is an example of human settlement and development that depend mainly on (over-used) local groundwater. The water demand is 221 000 m³ per day and chronic shortages reaching 25–30% are experienced. The increasing exploitation of the three major aquifers in this area, the Cap Verde Peninsula, combined with the effect of the drought, has led to a continuous decline in the groundwater level of this aquifer system and advancing seawater intrusion in several parts of it. In order to avoid further decline and degradation of the groundwater resources, the water authorities need to better understand the natural replenishment of the aquifers and the interrelationships between the different aquifers under exploitation. Through the integration of isotope investigations into ongoing hydrological studies and groundwater modelling, this goal was reached. In particular, isotopes demonstrated that in one of the aquifers the groundwater uptake is presently still compensated by natural replenishment (rainfall infiltration). One of the other aquifers, however, is being over-exploited, and in the third one the groundwater quality is deteriorating owing to infiltration of domestic waste water. The results of the project have encouraged the local water authorities to embark on studies for alternative sources of water.

was also invited to participate in a new United Nations project being launched to characterize and develop mitigation strategies for contaminated drinking water. The initial focus of this work will be on the arsenic contamination of drinking water in Bangladesh, which has affected millions of people and is a major public health issue.

Food and health

The increasing acceptance of food irradiation and the strengthened support given to the issue of food quality and safety through the newly established FAO/IAEA Training and Reference Centre at Seibersdorf (see Box 2) made a contribution to trade enhancement and improved food control systems. In this connection, it was agreed by member countries at a meeting in October to extend the mandate of the International Consultative Group on Food Irradiation, which expires in May 1999, for another three years, with a refocused work programme.

In Latin America, a five year study was completed on the development and validation of a diagnostic assay to distinguish animals vaccinated against brucellosis from those naturally infected, an essential prerequisite to the slaughter of animals carrying the disease. This was the largest serological study ever undertaken with regard to brucellosis — considered to be one of the most

important diseases affecting animals and, through the consumption of milk and dairy products, one of the most dangerous diseases affecting humans. Through the support provided by the Agency, an essential tool now exists that will significantly assist Member States in the future control and eradication of brucellosis.

From a figure of approximately 6% in the 1980s, the proportion of deaths in developing countries due to cancer rose to 9% by 1998. The Agency has accorded greater priority to cancer treatment using radiotherapy. During 1998, 18 national and regional training courses targeted at radiation oncologists, technologists operating machines and nurses caring for brachytherapy patients were held to help improve clinical practice. In addition, regional projects, particularly in Africa, resulted in a significant upgrading of equipment used in cancer control and an enhancement of the skills of medical personnel. A radiation centre was set up in Ghana, in addition to establishments in Namibia and Ethiopia. As a result of Agency assistance, these centres now offer full teletherapy and brachytherapy cancer services.

Partnerships in the transfer of technology

A special effort was made during 1998 to work with and through partners in the implementation of the Agency's technical co-operation programme. The

BOX 2

FAO/IAEA Training and Reference Centre for Food and Pesticide Control

Extrabudgetary funds from the Governments of Austria and Sweden facilitated completion of the construction and equipping of the Centre at the Agency's Laboratories in Seibersdorf, near Vienna. The main objective is to strengthen the analytical capacities of Member States to fulfil the requirements for implementing international standards and agreements relevant to food quality and safety, particularly those covered by the 'Agreement on the Application of Sanitary and Phytosanitary (SPS) Measures' being enforced by the WTO.

The activities of the Centre focus on training, standardization of analytical methods and the provision of information to national food control laboratories relevant to determining pesticides, veterinary drug residues, radionuclides and other contaminants in food and feed covered by the FAO/WHO Codex Alimentarius Food Standards.

resulting synergy both helped to bring extra financial resources to projects and encouraged regional collaboration. One example was a project in Eastern Europe on medical education for nuclear accident preparedness, co-ordinated through the Boston University Medical Center. The approach used was a major departure from tradition, involving outsourcing that brought together ten international centres. Some \$3 million will have been spent by the end of the project, with only 40% contributed by the Agency. Another innovative, cost saving, feature was the organization of courses using teleconferencing systems to connect various centres during training sessions. The project has trained more than 100 medical doctors, developed a curriculum and a train-the-trainers programme, and has helped emergency centres in six countries become capable of delivering the curriculum.

Nuclear energy

Contribution of nuclear power

In 1998, there was a rise in world electricity consumption by about 3% over the figure for 1997. Nuclear energy continued to contribute about 16% to the overall total. If the nuclear generated energy had been produced by the current mix of fossil fuels, total energy related carbon emissions would have been increased by some 8%.

According to data reported to the Agency's Power Reactor Information System, there were 434 nuclear power plants in operation at the end of 1998: 151 in Western Europe, 70 in Eastern Europe, 118 in North America, 5 in Latin America, 11 in the Middle East and South Asia, 2 in Africa and 77 in the Far East. Four new nuclear plants were connected to electricity grids, three in the Republic of Korea and one in Slovakia, representing 2958 MW(e) of capacity. Construction started on two plants in China and one in Japan, bringing the total number of plants under construction around the world to 36, equivalent to a total generating capacity of 27 536 MW(e). Seven reactors were shut down during the year (equivalent to 5776 MW(e)), including two Canadian reactors which are expected to restart in the future. Accumulated operating experience reached approximately 9010 reactor-years.

The largest contributor to the world installed nuclear capacity remained the USA (28%), followed by France

(18%) and Japan (12.5%). Germany's contribution was 6.4%, followed by the Russian Federation with 5.7%, Ukraine with about 3.9%, the United Kingdom with 3.7%, the Republic of Korea with 3.5%, and Sweden and Canada with about 2.9%.

Lithuania continued to be the country with the highest contribution of nuclear power to national electricity production (77%), followed by France (76%), Belgium (55%), Sweden (46%), Ukraine (45%), Slovakia (44%), Slovenia (38%), Bulgaria (42%), and the Republic of Korea and Switzerland (41%). In an additional six countries, more than 25% of the electricity was produced by nuclear power.

In the European Union, the most likely scenario for nuclear power is that capacity will remain at about its present level in the coming years, with life extension programmes implemented whenever needed. However, at the policy level a number of important developments took place during the year. Most important in this respect were events in Germany. After elections in September the coalition agreement for the new Government stated that the use of nuclear power would be stopped and invitations issued for talks concerning a new energy consensus. In France, a final decision on Superphénix, the 1200 MW(e) demonstration fast breeder reactor, was taken in early 1998: it will be shut down and dismantled. The partially burnt and the unburned newly fabricated cores will be reprocessed. With the completion of Civaux 2 in France, planned to be connected to the grid in mid-1999, there were no reactors under construction in the European Union. Utilities in Finland were seeking Government approval to build a fifth reactor.

In Turkey, bids by three international consortia for the first nuclear power plant, being planned at Akkuyu on the eastern Mediterranean coast, were being evaluated.

In Asia, planning for the expansion of nuclear power continued, particularly in China, India, Japan and the Republic of Korea. However, the financial crisis in this region slowed down the expected growth in energy demand.

South Africa continued with the development of the 117 MW(e) Pebble Bed Modular Gas Cooled Reactor, with the Agency assisting in its assessment.

In Brazil, it was announced that the Angra-2 nuclear power plant would be inaugurated in 1999. A

feasibility study concluded in March 1998 that it would take five years to complete Angra-3.

Energy from nuclear fusion

Six years of international collaborative work under the auspices of the Agency on the International Thermonuclear Experimental Reactor (ITER) Engineering Design Activities (EDA) were completed, culminating in a final design report which was approved by the ITER Council in June. Following completion of the report, the Council agreed on guidelines for a new work programme. A priority task is the design of reduced cost options which would still meet the overall objective of demonstrating the scientific and technological feasibility of fusion energy for peaceful purposes. An Amendment to the ITER Agreement extending the EDA for three years was signed by the European Union, Japan and the Russian Federation. In September, the USA agreed to continue its participation in the extended EDA until July 1999.

Reducing greenhouse gases

The Annex I Parties to the United Nations Framework Convention on Climate Change (i.e. the industrialized countries and the economies in transition) gave binding commitments under a Protocol adopted in Kyoto in December 1997 to reduce by about 5% their emissions of greenhouse gases (GHG) by the year 2010 as compared with the 1990 levels. They confirmed this pledge at a further meeting in Buenos Aires in November. Although the Kyoto Protocol does not impose any such commitments on the non-Annex-I countries (i.e. developing countries), it is certain that unless concerted efforts are made to check the growth of GHG in these countries as well, the stabilization of concentrations of these gases in the global atmosphere at an acceptable level cannot be achieved. Nuclear energy is a relevant energy source in this context. One of the flexible mechanisms envisaged under the Kyoto Protocol is the 'Clean Development Mechanism'. This creates a means for transferring credits obtained for reducing emissions from projects in developing countries to the Annex I sponsors of those projects. It combines the objectives of assisting developing countries in achieving sustainable development (through technology transfer and financial assistance) with assisting Annex I Parties in complying with their commitments under the Protocol in a cost effective manner.

Fuel cycle and radioactive waste

Supply of nuclear fuel

World uranium demand increased moderately in 1998 to some 61 000 tonnes and was met by supplies of about 38 000 tonnes from mining and milling (60% of the total requirement). The remaining material needed to fuel reactors came primarily from stockpiles, from the use of mixed oxide (MOX) fuel, and from reprocessed uranium and the dilution of high enriched uranium. The number of nuclear power plants loaded with MOX fuel reached 32 (with about 50 more licensed or undergoing licensing) in Belgium, France, Germany, Japan and Switzerland. In Belgium and Switzerland, a batch average burnup of MOX fuel similar to that of uranium fuel was attained.

Back end of the fuel cycle and waste management

Annual spent fuel arisings amounted to about 10 500 tonnes of heavy metal, with some 130 000 tonnes in storage facilities around the world. The inventory of separated civil plutonium was estimated to be about 200 tonnes — the highest figure since reprocessing began. The Agency held a symposium on the storage of spent fuel from power reactors in November (see Box 3).

Site selection and characterization studies for high level long lived radioactive waste and spent fuel disposal facilities continued to be the main focus of many national programmes. Important developments occurred in several of these programmes. Sweden moved to the second phase of development of the Hard Rock Laboratory in Aspö, implementing a full scale prototype experiment. After a four year siting study, the French Government decided in December to authorize the construction and operation of two underground laboratories in clay and granite formations for research on the possibilities of a reversible or non-reversible repository in a deep geological formation. The first laboratory will be built in eastern France (Meuse site), while the granite formation laboratory requires the selection of a new site, for which preparations will start in 1999.

The US Department of Energy is responsible for an estimated 140 000 m³ of transuranic (TRU) waste left from the production of nuclear weapons and the

dismantling and cleanup of weapons production sites. This waste is dispersed in various sites in temporary retrievable storage. The construction and testing of the underground Waste Isolation Pilot Plant (WIPP) facility at Carlsbad, New Mexico, as well as the facilities and equipment required to safely transport, receive, handle and dispose of TRU wastes, were essentially completed in the last decade. The Agency, together with the OECD/NEA, conducted an international review of the safety documents required under US regulations. In May 1998, the Environmental Protection Agency certified that WIPP complies with all applicable environmental radiation protection standards.

At a meeting in Murmansk in November, the Contact Expert Group for International Co-operation in Radioactive Waste Management with the Russian Federation approved a list of highest priority projects covering spent fuel and radioactive waste resulting from the decommissioning of nuclear submarines. Most of the tasks to be undertaken under these projects require the construction of new facilities, the acquisition of equipment, and multimillion-dollar funding.

Safety issues in the use of nuclear energy and technology

The issues shaping the global safety agenda were illustrated by the topics covered at an Agency conference in Vienna: safety management; occupational radiation protection; backfitting, upgrading and modernization of nuclear power plants; chronic exposure to residual materials; long term waste disposal; and regulatory strategies.

Legal instruments

An important component of the global safety agenda is represented by the binding legal instruments developed over recent years. By the end of 1998, 49 States had become Contracting Parties to the Convention on Nuclear Safety and 37 States had signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, though only 5 had ratified it.

In addition to these binding legal instruments, an important step forward was the review of the Agency's

BOX 3

Symposium on Storage of Spent Fuel from Power Reactors

An opportunity for representatives of governmental authorities, utilities, industry and research organizations to exchange information on the latest technologies and policies for spent fuel storage was provided by an international symposium which was held in Vienna from 9 to 13 November in co-operation with the OECD/NEA. The participants discussed the current situation and the major factors influencing national policies in this field, and identified the most important directions for national efforts and international co-operation:

- The interim storage of spent fuel will be longer than initially anticipated and extended operation of existing facilities will therefore be required;
- Additional fuel storage capacity is needed;
- The design of spent fuel storage facilities should in the future take into account spent fuel originating from advanced fuel cycle practices (high burnup and the use of MOX fuels);
- An integrated approach to spent fuel storage that would address the transport, storage and disposal of spent fuel, while at the same time using flexible multipurpose systems, is required.

document INFCIRC/225/Rev. 3, *The Physical Protection of Nuclear Material*. This review resulted in recommendations to improve the structure and clarity of the document and to take account of improved technology and current practices.

Nuclear regulation

A strengthening of relations between nuclear regulators was apparent in 1998. The first meeting of the 'Network of Regulators of Countries with Small Nuclear Programmes' was held in Vienna in September. Nuclear regulatory authorities in the States of the European Union that have nuclear power plants announced their intention in December to form a new Western European Nuclear Regulators Association.

Safety missions and advice

A landmark was reached in 1998 with the organization of the one hundredth mission under the Agency's

Operational Safety Assessment Review Team programme (see Box 4). A special Agency extra-budgetary programme on the safety of WWER and RBMK reactors ended in 1998 (see Box 5).

The startup in June of the first unit of the Mochovce nuclear power plant in Slovakia — a WWER-440/213 reactor with extensive safety upgrades — was accompanied by discussions on safety matters in which the Agency also participated. They focused on the status of the reactor pressure vessel, the design modifications and the seismic safety of the plant.

Safety in transport

In May, the transport of spent fuel in France, Germany and Switzerland was stopped after inspections by the French regulator found that for a number of years a high percentage of the flasks and wagons arriving at the rail terminal used by the reprocessing plant at La Hague had levels of non-fixed contamination exceeding 4 Bq/cm² beta-gamma activity — a level specified in

BOX 4

100 OSART missions: A milestone in ensuring the operational safety of nuclear power plants

The Operational Safety Assessment Review Team (OSART) programme was created in 1982 as a service to the Agency's Member States whereby an international team of experts conducts a three week in-depth review of operational safety performance at a power plant at the request of a Member State. The first OSART mission took place at the Kori nuclear power plant in the Republic of Korea in August 1983, and the hundredth mission was carried out at the Golfech plant in France.

The one hundred OSARTs were conducted at 73 different plant sites, in 29 countries on all continents that have nuclear power plants. Over 1100 team members participated in these missions. More than 800 of these were provided by the nuclear industry worldwide in support of the Agency's own staff.

OSART missions focus on the performance of management processes and plant personnel in achieving safe operation, and usually review performance in eight areas: management, organization and administration; training and qualifications; operations; maintenance; radiation protection; chemistry; and emergency planning and preparedness.

Benefits to the plant from an OSART mission stem from the preparation and self-assessment before the visit, as well as the exchange of experience and good practices with the experts. The OSART report, sent to the government and the regulatory body, also promotes openness and transparency.

the Agency's Transport Regulations and in many national regulations as a 'clean' level for shipments. Further measurements and consultation of records indicated the presence of such contamination on a significant fraction of empty flasks arriving at nuclear power plants in France, Germany and Switzerland, and full flasks arriving at La Hague and at Sellafield in the United Kingdom. Although studies showed that radiation exposure of rail workers or the public had been extremely low, the authorities in France, Germany and Switzerland required the introduction of improved technical procedures, monitoring, documentation and information flow. Transports were resumed in France in July 1998 following the implementation of some measures and subject to others being carried out. As of the end of 1998, transports in Germany and Switzerland remained suspended.

Several States and non-governmental organizations continued to voice more general concerns about the international transport of spent fuel and radioactive waste. A resolution adopted by the Agency's General Conference in September invited States shipping radioactive materials "to provide, as appropriate, assurances to potentially affected States upon their request that their national regulations take into account

the Agency's Transport Regulations; and to provide them with relevant information relating to shipments of radioactive materials. The information provided should in no case be contradictory to the measures of physical security and safety."

Radiation sources not under regulatory control

Radiation sources not under regulatory control ('orphan' sources) continued to pose a problem (see Box 6). In July, three caesium-137 sources were found in Georgia, apparently from a former Soviet civil defence base. The dose rates close to the largest of the sources were up to about one hundred million times natural background levels. At the request of Georgia, the Agency assisted in the recovery operation and, with the help of the Government of France, undertook biological dosimetry of the potentially affected population. Two other sources — both strontium-90 — were discovered in October near Khaishi. The Agency sent a mission to assess the situation.

In June, very low concentrations of caesium-137 were detected in air samples at a number of places in Europe. Investigations determined that the cause was a source

BOX 5

Safety evaluation of WWER and RBMK plants

In response to requests from Member States operating Soviet designed WWER model 230 nuclear power plants, the Agency launched a major international programme in 1990 to evaluate this first generation of Soviet designed reactors and provide safety assistance to plant operators and regulators. The programme was undertaken as a complement to existing national, bilateral and international activities and was extended in 1992 to other types of WWERs and to RBMKs. It was financed primarily by voluntary contributions as an extrabudgetary programme (EBP), with some activities being funded through the Agency's regular budget or through national and regional technical co-operation projects. Steering committees provided independent advice on the conduct of this EBP.

A significant achievement of the programme was the preparation of 'Safety Issue Books' detailing design and operational safety issues and their importance for the plants under consideration. International consensus was reached on safety issues related to WWERs and RBMKs and on the priority measures required. The programme findings and associated publications are being widely used as a technical basis for the development of safety upgrades, reviews by national regulatory authorities, and the establishment of safety priorities in national, bilateral and international programmes.

apparently delivered in a load of scrap metal and melted in a steel plant in Algeciras in southern Spain. Although the incident did not require invocation of the Convention on Early Notification of a Nuclear Accident, the mechanisms established under the Convention allowed the Agency to rapidly disseminate information to Member States.

Radiological assessment

In 1996, following a request from the Government of France, the Agency embarked on a study of the

radiological situation at the Atolls of Mururoa and Fangataufa, in French Polynesia, where France conducted 193 'expériences nucléaires' (nuclear experiments) between 1966 and 1996. The study was designed to assess the residual radiological conditions at the atolls after the end of all the experiments and also the future radiological situation. It concluded that: there will be no radiation health effects which could be either medically diagnosed in an individual or epidemiologically discerned in a group of people; the expected radiation dose rates and modes of exposure are such that no effects on biota population groups could arise; no remedial action at the atolls is needed on

BOX 6

Conference on the Safety of Radiation Sources and Security of Radioactive Materials

The first ever major international conference devoted to the safety of radiation sources and security of radioactive materials was held in Dijon, France, in September. It was organized by the Agency and co-sponsored by the European Commission, INTERPOL, WCO and the Atomic Energy Commission of France.

The 10 technical sessions reviewed 12 major topics:

- *The safety of radiation sources* — regulatory control, safety assessment techniques, engineering and managerial measures, lessons from experience, international co-operation through reporting systems and databases, verification of safety through inspection and the use of performance indicators for a regulatory programme;
- *The security of radioactive materials* — measures to prevent breaches in the security of radioactive materials, detection and identification techniques for illicit trafficking, response to detected cases and seized radioactive materials, strengthening awareness, training and information exchange.

The conference discussed:

- The need for Member States to ensure effective systems of control and for preventing, detecting and responding to illicit trafficking in radioactive materials;
- Major problems related to human errors, caused by a lack of training, insufficient commitment of managers, and the absence of procedures and supervision;
- Problems in developing countries connected with the import and use of radiation sources without effective maintenance and the lack of expertise of regulatory authorities in ensuring the safety of the imported equipment, as well as inadequate resources;
- The problem of 'orphan' sources ending up in the public domain.

radiological protection grounds, either now or in the future; no further monitoring at Mururoa and Fangataufa Atolls is needed for purposes of radiological protection; and the expected extent of changes in the conclusions due to uncertainties in the parameters used in the modelling is slight. The findings, conclusions and recommendations of the study were presented in June in the Fiji Islands to high level officials and selected representatives of member countries of the South Pacific Forum, and in Tahiti to authorities of French Polynesia, the French Government, and various other organizations and authorities. The results were also issued in a nine volume set, together with the

proceedings of a specially convened international conference held in Vienna in June–July.

Remediation

The Emu site in South Australia, used by the United Kingdom for two atmospheric nuclear weapons tests in 1953, was returned to its Aboriginal owners at the end of March 1998, following remediation work. The criterion applied was that individuals should not receive more than about twice the global average background dose per year from permanent occupancy of the site.

BOX 7

Additional Protocols: Dates of signing

Australia	23 September 1997	Ireland	22 September 1998
Armenia	29 September 1997	Italy	22 September 1998
Georgia	29 September 1997	Luxembourg	22 September 1998
Uruguay	29 September 1997	Netherlands	22 September 1998
Philippines	30 September 1997	Portugal	22 September 1998
Poland	30 September 1997	Spain	22 September 1998
Lithuania	11 March 1998	Sweden	22 September 1998
Ghana	12 June 1998	United Kingdom	22 September 1998
USA	12 June 1998	Uzbekistan	22 September 1998
Jordan	28 July 1998	Bulgaria	24 September 1998
Austria	22 September 1998	Canada	24 September 1998
Belgium	22 September 1998	Holy See	24 September 1998
Croatia	22 September 1998	New Zealand	24 September 1998
Denmark	22 September 1998	Hungary	26 November 1998
Finland	22 September 1998	Slovenia	26 November 1998
France	22 September 1998	Japan	4 December 1998
Germany	22 September 1998	China	31 December 1998
Greece	22 September 1998		

- Four Additional Protocols entered into force in 1998: the Additional Protocols concluded by the Holy See, Jordan and New Zealand entered into force upon signature; and the Protocol concluded with Uzbekistan entered into force on 21 December. As of 31 December 1998, a total of 5 Additional Protocols were in force (Australia's Additional Protocol entered into force on 12 December 1997).
- In addition, the Board of Governors approved Additional Protocols with Cyprus, Monaco and Slovakia. As of 31 December 1998, the Board had approved Additional Protocols for 38 States.

Verification of the peaceful uses of nuclear energy

In 1998, the Agency continued the development and implementation of measures to strengthen its safeguards system. Environmental sampling started to become a routine safeguards measure, and the necessary infrastructure for using remote monitoring as a safeguards tool was being set up. As a result of the strengthening measures of recent years, the Agency's information base has become broader and this process will accelerate when States submit information under the Protocol Additional to Safeguards Agreements. A model for such an Additional Protocol was adopted in

1997. During 1998, the number of signatories to such Protocols increased from 6 to 35 (see Box 7). Under the new Protocol, inspector access will be broader than before, and during the year guidelines for such complementary access were developed.

Particular challenges remained with regard to the Agency's mandates in the Democratic People's Republic of Korea (DPRK) and in Iraq. The Agency was still unable to verify the correctness and completeness of the initial declaration of nuclear material made by the DPRK, and in Iraq the implementation of the Agency's ongoing monitoring and verification (OMV) plan faced particular difficulties during the year.

BOX 8

Senior Management Conference

At a Senior Management Conference held in January, the Director General, Department Heads and Division Directors reviewed internal management processes and identified a number of issues that need to be addressed. As a follow-up to the Conference, an Action Plan was developed and a number of initiatives were taken in the course of the year:

- A Programme Co-ordination Committee and an Office of Programme Support and Evaluation were established to ensure the coherence and co-ordination of all Agency programmes.
- A new Office of Information Management was tasked with rationalizing information processing and documentation flow and dissemination within and outside the Secretariat.
- A study of the feasibility of a fully biennial Agency programme cycle was prepared and a report submitted to Member States for discussion.
- Current procedures and processes for the preparation by the Secretariat of reports on its activities were reviewed and clarified to achieve more concise reporting on programme and financial performance in a reduced number of documents.
- A number of actions were initiated in the area of human resource management to ensure that human resources are better matched to programme requirements.
- A new policy framework for an integrated training curriculum for 1998 and beyond was approved, with emphasis on management training.
- Recruitment procedures were simplified to expedite the process while preserving the requirement for excellence in the candidates selected.

Democratic People's Republic of Korea

Because the Agency is still unable to verify the correctness and the completeness of the initial declaration of nuclear material made by the DPRK, it is unable to conclude that there has been no diversion of nuclear material in the DRPK.

The safeguards agreement between the DPRK and the Agency remains binding and in force, and the Agency is continuing to implement safeguards measures in the DPRK. These measure include monitoring 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”

BOX 9

Report of the Senior Expert Group

The Senior Expert Group made the following general recommendations:

- The Agency should continue to be guided and motivated by its mission “to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world”, recognizing that an important prerequisite of achieving this mission is to improve confidence in nuclear technology in many Member States. In fulfilling its mission, the Agency should pursue three strategic objectives that are complementary and of equal importance:
 - Promote the safe use of nuclear technology;
 - Ensure that undertakings related to the peaceful use of nuclear energy are implemented;
 - Assist Member States, particularly developing Member States, in the peaceful uses of nuclear technology.
- The Agency should continue to be guided by the principle that its credibility is based on its scientific and technical competence. This can be maintained only if the Agency keeps itself at the forefront of nuclear science and technology.
- The Agency should remain scientifically objective in all its work.
- The Agency, through effective management and integrated programmes, should continue to pursue synergies between its various programmes, including its technical co-operation programme.
- The Agency should strive to enhance its co-operation with other organizations and with private enterprise in order to maximize the value of its programmes while achieving all possible economies; this co-operation should take the form of formal agreements wherever possible and the Agency should ensure that the results of such co-operation are equally accessible to all Member States.
- The Agency should continue critical reviews of its programmes, amongst other ways by strengthening the Programme Performance Assessment System and applying it more widely as a fundamental management tool.
- Concerted efforts should be made to ensure that core activities are funded mainly through the regular budget, thereby reducing dependence on extrabudgetary resources. Nevertheless, innovative cost sharing or cost allocating mechanisms should be explored where necessary to achieve priority goals.

concluded in October 1994 between the DPRK and the USA.

Certain issues relevant to the monitoring of the “freeze” remain unresolved. In addition, at three technical meetings held during 1998 between DPRK representatives and the Agency, no progress was made regarding the preservation by the DPRK of information required by the Agency for the verification of the correctness and completeness of the DPRK’s initial inventory.

The DPRK remains in non-compliance with its safeguards agreement.

Iraq

Continuing difficulties experienced by the United Nations Special Commission (UNSCOM) and the Agency in gaining access to sites described by Iraq as “sensitive” were resolved by a Memorandum of Understanding signed on 23 February by the Secretary-General of the United Nations and the Deputy Prime Minister of Iraq.

On 25 March, Iraq provided the Agency with a consolidated version of its ‘Full, Final and Complete Disclosure’, and on 25 April it issued a ‘Summary of Technical Achievements’ of its clandestine nuclear programme. The Agency accepted both documents as being consistent with its technically coherent picture of Iraq’s clandestine nuclear programme.

On 5 August, Iraq announced that it was suspending co-operation with UNSCOM and the Agency. The restrictions that Iraq placed on Agency inspections resulted in significantly reduced assurances of Iraq’s compliance with its obligations under United Nations Security Council resolutions.

On 31 October, Iraq ceased all co-operation with UNSCOM. Although Iraq placed no additional restrictions on the Agency’s ongoing limited implementation of its OMV plan, the escalating situation caused the Director General to temporarily relocate Agency personnel from Baghdad to Bahrain, on 11 November, after which Agency inspection activities were interrupted during a seven day period. For similar reasons, the Director General again withdrew Action Team personnel on 16 December. Since that time the Agency has been unable to implement its mandate in Iraq and, as a consequence, to provide any assurance that Iraq is in compliance with its obligations.

Fissile material treaty

In 1995, the United Nations General Assembly adopted a resolution outlining the elements of a mandate for the negotiation of a treaty banning the production of fissile material for nuclear weapons and other explosive devices. That resolution requested “the IAEA to provide assistance for examination of verification requirements for such a treaty as required.” After long delay, the Conference on Disarmament in Geneva reached agreement in August 1998 to create an ad hoc committee to begin negotiation of such an agreement. During 1998 the ad hoc committee did not reach any result.

Excess fissile material

The USA, the Russian Federation and the Agency continued working together on technical, legal and policy issues involved in verifying that fissile materials designated by the USA and the Russian Federation as no longer required for military purposes remain removed from nuclear weapon programmes. The Agency already applies voluntary offer safeguards to some plutonium and high enriched uranium released from the nuclear weapons programme of the USA.

The United Kingdom announced in July that substantial quantities of nuclear material previously in its military programme would become available for verification under its voluntary offer safeguards agreement.

Neptunium and americium

The Board of Governors at its November meeting discussed the proliferation potential of neptunium (Np) and americium (Am). Discussions on this subject will continue in 1999, particularly on the Secretariat’s recommendation to monitor international transfers of separated Np and Am to States with a comprehensive safeguards agreement and activities related to the production of separated Np and Am in those States.

Developments inside the Agency

Reviews and reforms

A comprehensive three level review process covering aspects of the Agency’s management and programme

was set in motion in early 1998. The first level consisted of measures to improve efficiency in three areas: policy and co-ordination, programme development and evaluation, and procedures and personnel. In January, a Senior Management Conference was convened which led to an Action Plan for better management (see Box 8). Many of the initiatives had been implemented by the end of the year.

In parallel with the internal management reform, an external review by a Senior Expert Group (SEG) was initiated to conduct an in-depth review of the programme activities of the Agency in the light of new developments and challenges. In addition to reviewing four of the Agency's Major Programmes, the SEG considered and made recommendations on the Agency's objectives, inter-programme relations and synergies, and the programme management process (see Box 9).

The third part of the reform process was a review of the role and management of public information and the Agency's outreach to civil society, particularly the nuclear, arms control and development communities and the media, using the most modern and effective tools. Development of a new strategy was started. 