

Overview

The year 2007 marked the fiftieth anniversary of the founding of the International Atomic Energy Agency. The Agency was the concrete expression of the international community's hopes and expectations for the peaceful applications of nuclear science and technology, as articulated in President Dwight D. Eisenhower's 1953 "Atoms for Peace" speech at the United Nations General Assembly. Five decades later, the Agency's activities remain vital in maximizing the use of nuclear technology for economic and social development and preventing its misuse for non-peaceful ends.

This chapter reviews some of the major global developments in 2007 in the areas of the applications of peaceful nuclear *technology*; global nuclear *safety* and the *security* of nuclear and radiological material and facilities; and the *verification* of compliance with nuclear non-proliferation undertakings.

Technology

Continuing population growth and longer human life spans are creating challenges for energy supply, human health, food security, water availability, resource conservation and environmental protection. The Agency, through its nuclear power, nuclear applications and technical cooperation programmes, assists Member States in addressing these challenges.

Nuclear power: Status and trends

Nearly every aspect of development — from reducing poverty to improving health care — requires reliable access to modern energy services. Faced with a growing shortfall of energy and rising fossil fuel prices, many countries are now looking to nuclear power as a way to increase the diversity of their energy supplies. A factor driving the renewed interest in nuclear power is that it emits almost no greenhouse gases.

At the end of 2007, a total of 34 reactors were under construction around the world. There were 439 nuclear power reactors in operation, supplying about 15% of the world's electricity. Three new reactors were connected to the grid — in China,

India and Romania — and one laid-up unit was reconnected in the USA. There were no reactor retirements. Construction began on seven new reactors — in China, France, the Republic of Korea and the Russian Federation, while construction resumed at Watts Bar 2 in the USA. The United States Nuclear Regulatory Commission (NRC) received applications for four new nuclear reactors, the first in nearly 30 years.

The Agency revised its medium term projections for global growth in nuclear power upwards in 2007, to 447 gigawatts of electric capacity (GW(e)) and 691 GW(e), respectively, in its low and high projections for 2030. Current expansion, as well as near term and long term growth prospects, remained centred on Asia. Of the 34 reactors under construction, 19 were in Asia, as were 28 of the last 39 new reactors connected to the grid.

Innovative technologies and approaches

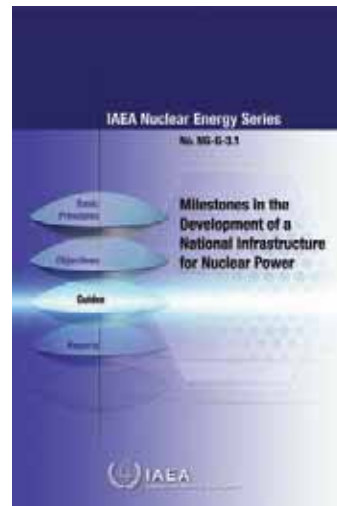
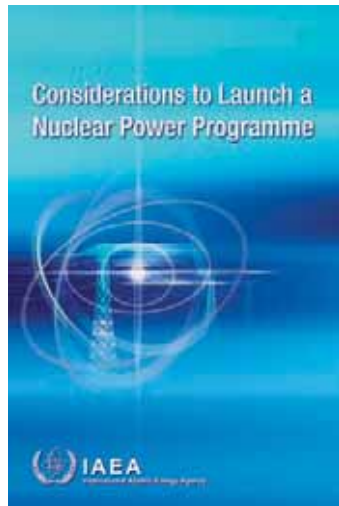
Technological innovation is a key factor in ensuring the long term sustainability of nuclear power. The Agency's International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)¹ provides a forum for studying innovative nuclear energy systems and associated

requirements. Based on assessments of national programmes carried out by INPRO members between 2005 and 2007, the Agency published recommendations on the INPRO methodology for the evaluation of different innovative nuclear energy systems. Comprising seven manuals covering economics, the environment, infrastructure, waste management and proliferation resistance, the methodology is being used in assessments carried out by Member States and by the European Commission, and in a study by several INPRO members of a closed fuel cycle with fast reactors. Phase Two of INPRO will focus on innovative approaches to infrastructure and institu-

¹ Currently, INPRO has 28 members: Argentina, Armenia, Belarus, Brazil, Bulgaria, Canada, Chile, China, the Czech Republic, France, Germany, India, Indonesia, Japan, Kazakhstan, the Republic of Korea, Morocco, the Netherlands, Pakistan, the Russian Federation, Slovakia, South Africa, Spain, Switzerland, Turkey, Ukraine, the USA and the European Commission.

LAUNCHING NUCLEAR POWER PROGRAMMES

In response to increasing interest among Member States in the steps necessary to introduce nuclear power into their energy mix, the Agency published a brochure entitled *Considerations to Launch a Nuclear Power Programme* (GOV/INF/2007/2). It was followed by the publication of *Milestones in the Development of a National Infrastructure for Nuclear Power* (IAEA Nuclear Energy Series No. NG-G-3.1), which provides a more detailed description for a technical audience of the complete range of infrastructure issues and the expected levels of achievement, or 'milestones', at the end of each of the three development phases outlined in the publication.



tional development for countries beginning nuclear power programmes, as well as on the establishment of collaborative projects between the members.

Another international initiative on innovative nuclear technologies, the Generation IV International Forum (GIF), coordinates research activities on six next generation nuclear energy systems: gas cooled fast reactors, lead cooled fast reactors, molten salt reactors, sodium cooled fast reactors, supercritical water cooled reactors and very high temperature reactors.² In 2007, agreement was reached on R&D projects for sodium cooled fast reactors for work on advanced fuel, component design and the non-reactor parts of the power plant.

For nuclear power to be a feasible option in countries and regions with small electricity grids, the design and production of safe and affordable small and intermediate size reactors (SMRs) will be essential. Although 7 of the 34 reactors under construction at the end of 2007 were smaller than

600 megawatts of electric capacity (MW(e)), and another three were between 600 and 700 MW(e), only one design in the SMR size range was being offered by a major vendor — the 700 MW(e) CANDU-6. Roughly a dozen innovative designs for SMRs are currently under development in various countries, and some could be deployed in the next decade. For example, in the Russian Federation construction of a 70 MW(e) floating nuclear plant using two water cooled reactors began in April; deployment is scheduled for 2010.

Energy assessment services

The prospects for growth in the nuclear power sector were reflected in increased demand for the Agency's assistance for energy assessments that include nuclear power. Algeria, Belarus, Egypt, Nigeria, Sudan, Tunisia and the member countries of the Gulf Cooperation Council, among others, requested assistance. For many Member States that are working with the Agency to build national capabilities for energy systems analysis, nuclear power is not yet a near term option. But of the 77 countries that receive Agency support for such

² The members of GIF are: Argentina, Brazil, Canada, China, Euratom, France, Japan, the Republic of Korea, the Russian Federation, South Africa, Switzerland, the United Kingdom and the USA.

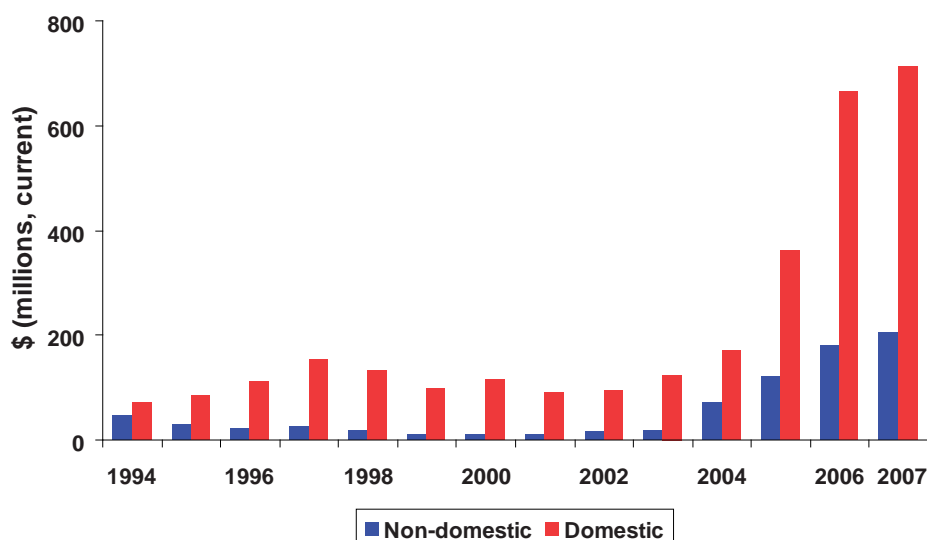


FIG. 1. Trends in reported uranium exploration and development expenditures.

studies, 29 now include an explicit assessment of nuclear power.

The number of people the Agency trained in energy system analysis increased by more than 50% in 2007. In response to still growing demand, the Agency conducted a pilot project using a web based training package. It is expected that such projects will help further expand training services in the future.

Uranium supply issues

Rising expectations for nuclear power and uncertainties about future uranium stocks led to a sharp rise in the uranium spot price in 2007. During the first six months the price almost doubled, from \$187 to \$351 per kg uranium (kg U). In the second half of the year the price dropped and stabilized at about \$230/kg U. The result was a revival of the uranium raw material industry, with significant expansion in exploration, mining and production activities all over the world (see Fig. 1).

The Agency, together with the OECD Nuclear Energy Agency, updated information on the global uranium market for publication in the 2008 edition of the 'Red Book'.³ 'Identified' uranium resources (with production costs less than \$130/kg U) increased by 15% to 5.5 million tonnes from the levels reported in the previous edition. Annual global uranium

production in 2007 remained around 40 000 tonnes, similar to the 2005 and 2006 levels, against average annual demand of some 67 000 tonnes. The balance was met by secondary sources such as civil and military stockpiles, by spent fuel reprocessing plants, and by re-enrichment of depleted uranium.

With the expansion of uranium exploration, mining and production activities, as shown in Fig. 1, firms faced shortages of experienced and trained personnel. In addition, many new companies with limited experience became interested in developing uranium resources. Countries with newly discovered uranium reserves were approached to become involved in uranium mining. Many of these countries do not have adequate regulatory or legislative infrastructures, nor do they have sufficient numbers of qualified staff to manage the proposed uranium mining activities. In 2007, the Agency, in partnership with the World Nuclear Association, brought together established regulators and mine operators from the major uranium producing countries to draft a set of best practices for managing radiation, health and safety, waste and the environment, and associated regulatory aspects.

Management of spent fuel

Annual discharges of spent fuel from the world's reactors total about 10 500 tonnes of heavy metal (t HM) per year. China, France, India, Japan and the Russian Federation reprocess most of their spent fuel or store it for future reprocessing. However, for a variety of technical reasons, only about 50% of

³ The Red Book, known formally as *Uranium 2007: Resources, Production and Demand*, is published by the OECD/NEA on behalf of both organizations.

the world's existing reprocessing capacity is being used. Canada, Finland, Sweden and the USA plan to dispose of their spent fuel directly, although the USA has initiated the Global Nuclear Energy Partnership (GNEP), which includes the development of advanced technologies such as recycling. In 2007, 19 countries signed GNEP's Statement of Principles, which included accelerated development and deployment of advanced fuel cycle technologies.

The Finnish, French, Swedish and US waste repository programmes remained the most developed, although none of these countries is likely to have a repository in operation much before 2020. Construction of the ONKALO underground characterization facility, which could be part of the repository at Olkiluoto in Finland, progressed according to plan. Following the introduction of new legislation, the French repository programme moved to the detailed siting phase, with the goal of applying for a licence in 2015. In Sweden, extensive site investigations resulted in plans for preparation of a licence application for the selected site in 2009. In the USA, preparation of the licence application for a repository at Yucca Mountain was well advanced, with the application planned for mid-2008.

Most countries are currently storing spent fuel while keeping abreast of developments associated with reprocessing and direct disposal. After more than 50 years of experience with storing spent fuel, there is a high level of technical confidence in both wet and dry storage technologies and their ability to cope with rising volumes and longer storage periods. A number of Agency studies focused on the technology for spent fuel storage and the long term behaviour of spent fuel and storage components.

Assurances of supply of nuclear fuel

In June, the Director General presented a report to the Board of Governors entitled *Possible New Framework for the Utilization of Nuclear Energy: Options for Assurance of Supply of Nuclear Fuel*. The report provided background information on proposals received by the Secretariat concerning the assurance of supply of nuclear fuel. It made it clear that any framework for the assurance of supply of nuclear fuel and fuel fabrication services, if established under the Agency's auspices, should be open to participation by all Member States on

the basis of uniform criteria established in advance by the Board of Governors, and applied in a consistent manner which would not prejudice any State's future fuel cycle options. The report noted that any assurance of supply mechanism would be envisaged solely as a backup to the market in nuclear material, fuels, technologies and services.

Research reactor fuel conversion activities

Nearly 100 civilian facilities around the world – mostly research reactors – operate with small quantities of high enriched uranium (HEU). However, according to many experts, most if not all of these facilities could also operate using low enriched uranium (LEU). The Agency, through its technical cooperation programme, continued to support Member State efforts to convert research reactors from the use of HEU to LEU fuel. In 2007, the Portuguese RPI reactor was fully converted, and the conversion of the Maria reactor in Poland made significant progress.

The Agency also supported Member States participating in international programmes to return research reactor fuel to the country of origin. For example, in the framework of the Russian Research Reactor Fuel Return Programme, and under contracts arranged by the Agency, two shipments totalling 12.7 kg of fresh HEU fuel were made from Poland and Vietnam to the Russian Federation. In addition, the Agency assisted in the shipment to the Russian Federation of 80 kg of irradiated HEU fuel and 280 kg of irradiated LEU fuel of Russian origin from the Řež Nuclear Research Institute in the Czech Republic.

Management of nuclear knowledge

The OECD/NEA's Steering Committee for Nuclear Energy noted in 2007 that because of the decline in nuclear education and training, the nuclear sector risked facing a shortage of qualified staff to ensure the appropriate regulation and operation of existing and planned nuclear facilities, and the European Commission recommended that education and training in nuclear science and engineering be strengthened. The Scientific Forum at the Agency's 2007 General Conference concluded that the Agency is well positioned to play an important role in

“After more than 50 years of experience with storing spent fuel, there is a high level of technical confidence in both wet and dry storage technologies ...”

expanding the capacity of colleges, universities and nuclear research institutes in these areas.

Following a period of decline, there was a modest increase in the number of university students enrolled in nuclear sciences. Prospective future growth in nuclear power generation, recent initiatives in technology innovation, increased government funding, and acceleration or renewal of nuclear programmes in a number of States attracted new students.

Academic networking and cooperation both expanded in 2007. The European Nuclear Education Network now has 28 members, plus 16 associate members, from 17 countries. The third Summer Institute of the World Nuclear University was held in Taejon in 2007, attracting 102 fellows from 35 countries. The Asian Network for Education in Nuclear Technology has 28 member institutions from 12 countries.

Nuclear applications

Millions of people benefit from a wide range of applications of nuclear technology. These include plant breeding for greater food security, the sterile insect technique (SIT) to control insect pests, the effective management of water resources and life saving medical procedures.

Food and agriculture

In 2007, the Agency continued to assist Member States with tools for rapid diagnosis and protocols for animal disease early warning systems, holding regional training courses for technicians from laboratories in over 40 countries in Africa and Asia. The courses enhanced the capabilities of the diagnostic laboratories (established with the Agency's support during the FAO rinderpest campaign), increasing the use of nuclear and nuclear related molecular diagnostic technologies. The impact of such technologies was graphically demonstrated in the Rift Valley fever outbreak in Sudan in August 2007, when veterinary and human diagnostic laboratories played a key role in the diagnosis and control of the disease.

In Citrusdal, South Africa, the false codling moth is the most serious pest affecting the citrus export industry. In response, the citrus industry decided to integrate the use of SIT with other control tactics. A new mass rearing facility was constructed in 2007;

Agency support included a technical cooperation project to procure rearing equipment and for the provision of a cobalt-60 source in a cost sharing agreement with Citrus Research International.

The Agency made progress in examining the feasibility of using SIT against the malaria transmitting mosquito *Anopheles arabiensis*. Sufficient information about the insect was collected to allow planning for a production facility and release strategy for control purposes in a selected area in Sudan. An Agency supported programme developed a conventional genetic strain that allows mass elimination of more than 99% of the females. Studies on sterilization and male competitiveness (i.e. sterilized males

competing against wild males for wild females) in Sudan and in the Agency's Laboratories, Seibersdorf, demon-

strated that good competitiveness can be accomplished using irradiated males. Sterilized marked males were released in Sudan in 2007 so that dispersal and survival could be studied.

In agriculture and food production, the Agency's technical cooperation and coordinated research projects supported more than 60 Member States in 2007 in the use of mutation induction, facilitated by biomolecular technologies, to enhance crops and improve food security. This led to the development of a series of novel mutant strains, such as salt tolerant rice, enhanced quality cassava and high yielding groundnut.

Management of water resources

Lack of freshwater constrains the development efforts of many Member States. Environmental scientists predict further impacts due to climate induced changes in precipitation and river flows. Member States continue to seek the Agency's assistance in using isotope techniques to manage their water resources.

The Agency made progress in its efforts to bring isotope hydrology into the mainstream of national and international water resource related programmes. An international symposium on advances in isotope hydrology, held in May in Vienna, reviewed Agency assisted projects in which isotope techniques were used for water resources management. Another initiative was the publication of an *Atlas of Isotope Hydrology for Africa* to provide Member States with an overview of isotopes in aquifer and river hydrology in 26 countries. In

"Millions of people benefit from a wide range of applications of nuclear technology."

addition, the Agency trained scientists from ten countries in Asia, Africa and Latin America in the use of a robust, low cost laser spectroscopy instrument for isotope analysis. This instrument, which the Agency helped test and adapt, is being provided to Member States through technical cooperation projects.

Human health

The Agency strengthened its collaboration with WHO, UNICEF and other partners in priority areas in nutrition. For example, WHO was assisted in the planning of a regional consultative meeting in October in Bangkok which provided technical guidance to Member States in the region on incorporating HIV/AIDS treatments into national nutrition policies and programmes.

The IAEA Nobel Peace Prize Cancer and Nutrition Fund 'School for Nutrition' for the Asia-Pacific region focused on interventions to combat under-nutrition among infants and small children. Specifically, a 'nutrition school' held in Dhaka in April focused on applications of stable isotope techniques for use by nutritionists and other health professionals.

Positron emission tomography (PET), a technology that allows direct observation of molecular interactions in the living body through radiotracer techniques, is safe and non-invasive and is expected to have a major impact on understanding disease, on disease detection and on drug development. At an Agency conference in Bangkok in November, participants were taken to the Chulaborn Cancer Centre's PET facility, where they interacted with leaders in the field and learned about the role of PET in cancer treatment.

Quality assurance programmes, including independent external audits which evaluate the quality of a hospital's radiotherapy treatment system, are important in maintaining the quality of radiotherapy practices. Through its technical cooperation programme, the Agency conducted six Quality Assurance Team for Radiation Oncology missions in 2007. A report was also published entitled *Comprehensive Audits of Radiotherapy Practices: A Tool for Quality Improvement*.

Statistics from WHO project that more than 84 million people will die of cancer over the next ten years, 75% of them in developing countries. With

adequate funding and resources, however, more than 40% of all cancers can be prevented and 30% can be cured, if detected early and treated. In close collaboration with WHO and other international and national partners, the Agency continued to implement Model Demonstration Sites to develop multi-disciplinary cancer control capacity in Albania, Nicaragua, Sri Lanka, the United Republic of Tanzania, Vietnam and Yemen. These projects demonstrate the importance of comprehensive cancer control planning and the advantages of systematic, cross-sector collaboration in cancer care and public health.

By the end of 2007, the Agency's Programme of Action for Cancer Therapy (PACT) had secured donations exceeding \$530 000, with additional pledges and pending grants in excess of \$440 000, bringing funds raised by PACT since its inception to over \$3 million. In December, the OPEC Fund approved a \$7.5 million loan to fund cancer projects in Ghana on the basis of an 'imPACT review' — an

assessment conducted by the Agency and its partners. Member States continued to support PACT, with more than 20 offering to make avail-

able their cancer treatment institutions, hospitals and educational centres for collaborative projects. In addition, the US based National Foundation for Cancer Research established an endowment for PACT to facilitate charitable contributions.

Marine environment

Interest in using nuclear techniques to monitor and preserve the marine environment, and maintain seafood safety, increased in 2007. Studies at the IAEA Marine Environment Laboratory (IAEA-MEL) in Monaco improved understanding of how cadmium, a toxic metal, accumulates in shellfish. Collaborating with FAO and WHO, the Agency used this new information in the international harmonization of standards for acceptable levels of cadmium in seafood to enhance food safety and facilitate international trade.

In cooperation with the Regional Organization for Protection of the Marine Environment, oil pollution, persistent organic pollutants and trace metals were investigated in organisms and sediments from seven countries surrounding the Gulf. A study on the effects of ocean acidification was initiated at IAEA-MEL. This initiative, which employs radioisotopes

"Positron emission tomography (PET), ... is safe and non-invasive and is expected to have a ... major impact on understanding disease, ..."

of essential elements such as calcium and zinc to assess the effects of acidification on the growth and health of marine organisms, including commercial fish, responds to recommendations from the United Nations Inter-Governmental Panel on Climate Change for greater knowledge of the impacts of climate change on marine biodiversity.

Safety and Security

Global nuclear safety and security trends

The Agency continued to support national and international efforts for the safe and secure use of nuclear technology. Examples in 2007 included the publication of new safety requirements and guides, and the use of safety services to support the wider application of these standards.

While safety and security are primarily national responsibilities, failure can have far reaching consequences beyond national borders. In 2007, the nuclear industry continued to demonstrate a high level of safety and security around the world. There was consensus among States on the need to maintain vigilance in both areas, particularly in light of the renewed interest in nuclear power. The year also saw slow progress in the number of accessions and ratifications to the various safety conventions, which are important in improving safety performance and in raising public confidence.

The threat of nuclear terrorism remained a matter of concern to the international community. An international nuclear security framework has evolved from existing, strengthened and new international instruments. However, to be effective, more countries need to ratify and implement these instruments, particularly the Amendment to the Convention on the Physical Protection of Nuclear Material.

Agency safety standards and review services

The Commission on Safety Standards and the four Safety Standards Committees were reconstituted after the completion of their terms in 2007. The action plan approved by the Board of Governors in March 2004 was completed and continuous improvement in the quality of safety

standards was noted by Member States. The long term vision for the structure of the safety standards is being prepared with the aim of better integration of the nuclear, radiation, waste and transport safety standards. In 2007, one Safety Requirements and ten Safety Guides were approved.

The Agency's safety review services use the safety standards as a reference point, and play an important part in evaluating their effectiveness. In 2007, the Agency received an increasing number of requests from Member States for independent safety and security assessments. In addition to requests for Operational Safety Review Team, International Nuclear Security Advisory Service and International Physical Protection Advisory Service missions, Member States requested other services from the Agency. For example, the Agency began to review new nuclear power plant designs against the safety standards.

During the year, the Agency completed the transition of all its regulatory review services to the Integrated Regulatory Review Service (IRRS). The IRRS is now widely recognized as the international

mechanism for sharing regulatory knowledge and experience among senior regulators. In 2007, IRRS missions visited Australia, Japan and

Mexico. In addition, limited scope missions to Algeria, Cameroon, Gabon, Kenya, Mauritius, Mongolia, Niger, Uganda and Uzbekistan advised on actions for improving regulatory systems.

At the request of the Government of Japan, the Agency sent an expert mission to the Kashiwazaki-Kariwa nuclear power plant following a strong earthquake there on 16 July 2007. The main findings of the mission and the initial lessons learned were widely shared and used to focus international cooperation in this area.

Control of radioactive sources

Two States made commitments to implement the Code of Conduct on the Safety and Security of Radioactive Sources, increasing the total number from 88 to 90. In June, technical and legal experts met to share their experience in implementing the Code and its supplementary Guidance on the Import and Export of Radioactive Sources. The meeting recognized that differences in the level of implementation of the Code's provisions among Member States were dependent on, inter

alia, facilities and services available to the persons authorized to manage the radioactive sources, training of staff in the regulatory body and law enforcement agencies, legislation and regulations on safety and security of radioactive sources, and financial resources.

Management of radioactive waste and decommissioning

There is growing international interest in the establishment of comprehensive national radioactive waste management policies and implementation strategies, as well as the necessary legal infrastructure, that will ensure that all radioactive waste is appropriately managed and that a safe solution can be found for the disposal of all types of radioactive waste. The concept of a common framework linking radioactive waste types to disposal options in a manner that follows international safety standards, with due regard for local circumstances, has been evolving for a number of years. The Agency completed three projects on the harmonization of safety assessment processes in 2007, focusing on near surface radioactive waste disposal facilities, demonstration of safety during decommissioning of nuclear facilities, and environmental modelling for radiation safety. These projects produced methods and parameters for use by those involved in preparing safety assessments.

Recognizing that the global volume of stored spent fuel and high level radioactive waste continues to increase, and expected storage periods continue to lengthen, the Agency conducted training courses through its Network of Centres of Excellence on Training and Demonstration in Underground Research Facilities on methodologies for the geological disposal of spent fuel and high level waste.

Governments are becoming increasingly aware of the need for early planning, adequate funding and long term strategies for decommissioning.

There is now also a need for national and international mechanisms

to preserve and maintain operational knowledge and decommissioning experience. Ten power plants around the world have been completely decommissioned, with their sites released for unconditional use, the latest two that were released in 2007 being the Big Rock Point and Yankee Rowe nuclear power plants in the USA. Seventeen plants were partially

dismantled and safely enclosed. Thirty-two were being dismantled prior to eventual site release, and thirty-four reactors were undergoing minimum dismantling prior to long term enclosure. The main lessons learned were that proven and available decommissioning technologies are generally preferable to new and innovative technologies, and that flexible and graded approaches to the regulation of decommissioning are necessary and now need further development and support.

In September, the Agency launched a Network of Centres of Excellence for Decommissioning to improve the flow of knowledge and experience among those engaged in decommissioning and to encourage organizations in developed Member States to contribute to the activities of Member States requiring decommissioning assistance. Some 15 Member States expressed their willingness to host training and demonstration events.

Radiation protection of patients

The rapid growth in the number of positron emission tomography, computed tomography and other advanced medical imaging facilities over the past few years has led to an increase in the exposure of patients to radiation. To help Member States reduce unnecessary exposure of patients to radiation, the Agency completed three reports in 2007 on radiation protection measures for these newer medical imaging technologies.

Incident and emergency preparedness and response

Emergency preparedness is the key to mitigating the consequences of any radiation emergency, whether caused by accident or by a malicious act. In 2007, the Agency strengthened global emergency preparedness with new and revised safety standards and guidelines based on lessons learned from

past responses. Agency seminars and training courses were held in many Member States.

The Agency also conducted three Emergency Preparedness Review missions in 2007.

The Agency, together with the International Association of Fire and Rescue Services, Pan-American Health Organization and WHO, published a *Manual for First Responders to a Radiological Emergency*. The Agency also strengthened the

“Emergency preparedness is the key to mitigating the consequences of any radiation emergency, ...”

Response Assistance Network in 2007, which was set up to assist countries affected by a nuclear or radiological emergency.

Civil liability for nuclear damage

Implementation of the existing international nuclear liability instruments remained limited, mainly because many States are not parties to these instruments. Moreover, the compatibility of the provisions of the instruments and the relationships between them are complex. The International Expert Group on Nuclear Liability (INLEX), established by the Director General in 2003 to help clarify issues regarding these instruments, held its seventh meeting in June 2007. In addition to addressing possible gaps and ambiguities in the existing nuclear liability regime, INLEX reviewed deficiencies in insurance coverage and considered possible ways of increasing the amounts of nuclear liability coverage through voluntary international pooling of operators' funds.

Nuclear security

A number of trafficking and other security related incidents in 2007 served as a forceful reminder of the need for the international community to continue addressing the security of nuclear and other radioactive material. In 2007, the Agency gave high priority to assisting Member States in these efforts, primarily by organizing training courses, workshops and assistance missions.

The Agency provided assistance for improved nuclear security arrangements in 19 States, mainly through enhanced physical protection measures and material accounting at facilities or locations, as well as through the movement of radioactive sources to secure locations and, from four States, through repatriation to the original State. Integrated Nuclear Security Support Plans (INSSPs) were initiated or established with 44 States to provide a long term work plan to address nuclear security issues. These plans are also a main vehicle for the Agency to facilitate coordination with bilateral support programmes and other international initiatives.

The capacity of nuclear regulatory authorities in ten countries was strengthened by the provision of inspection related equipment. Fifteen nuclear

security missions were conducted in 2007, covering evaluation of national legal nuclear security systems, physical protection, radiation safety, the security of radioactive source infrastructures, and nuclear material accounting and control. The Agency strengthened border control capabilities in 20 States by providing over 850 radiation detection instruments. It also trained more than 1500 people in nuclear security related responsibilities.

Efforts to ensure the effectiveness and sustainability of improvements in nuclear security continued. Guidance collected in IAEA Nuclear Security Series publications served as an important benchmark for Member States. The Agency published two guides in 2007, on the protection of nuclear power plants against acts of sabotage and the identification of radioactive sources and devices.

Support to major public events and cooperation with international partners

In 2007, the Agency supported Brazilian authorities in a project to ensure nuclear security at the Pan-American Games in Rio de Janeiro. Brazilian personnel were trained in detecting hidden, undeclared radioactive material. The Agency donated, or provided on loan, some 200 radiation detection instruments for this purpose. Similar activities started in cooperation with the Government of China for nuclear security at the 2008 Olympic Games in Beijing.

The Agency convened an international conference in November entitled 'Illicit Nuclear Trafficking: Collective Experience and the Way Forward'. Some of the major findings were: that universal adherence to the Amendment to the Convention on the Physical Protection of Nuclear Material and other international legal instruments was essential to enhance nuclear security; advances in nuclear forensics technologies, which can be used to trace the origin of radioactive material, should be available to States that currently do not have access to them; greater sophistication was needed in strategies for implementing detection capabilities, particularly with regard to the risk posed by unguarded borders; and effective communication strategies were needed to avoid unduly adverse public reactions to nuclear or radiological incidents.

"In 2007, the Agency supported Brazilian authorities in a project to ensure nuclear security at the Pan-American Games in Rio de Janeiro."

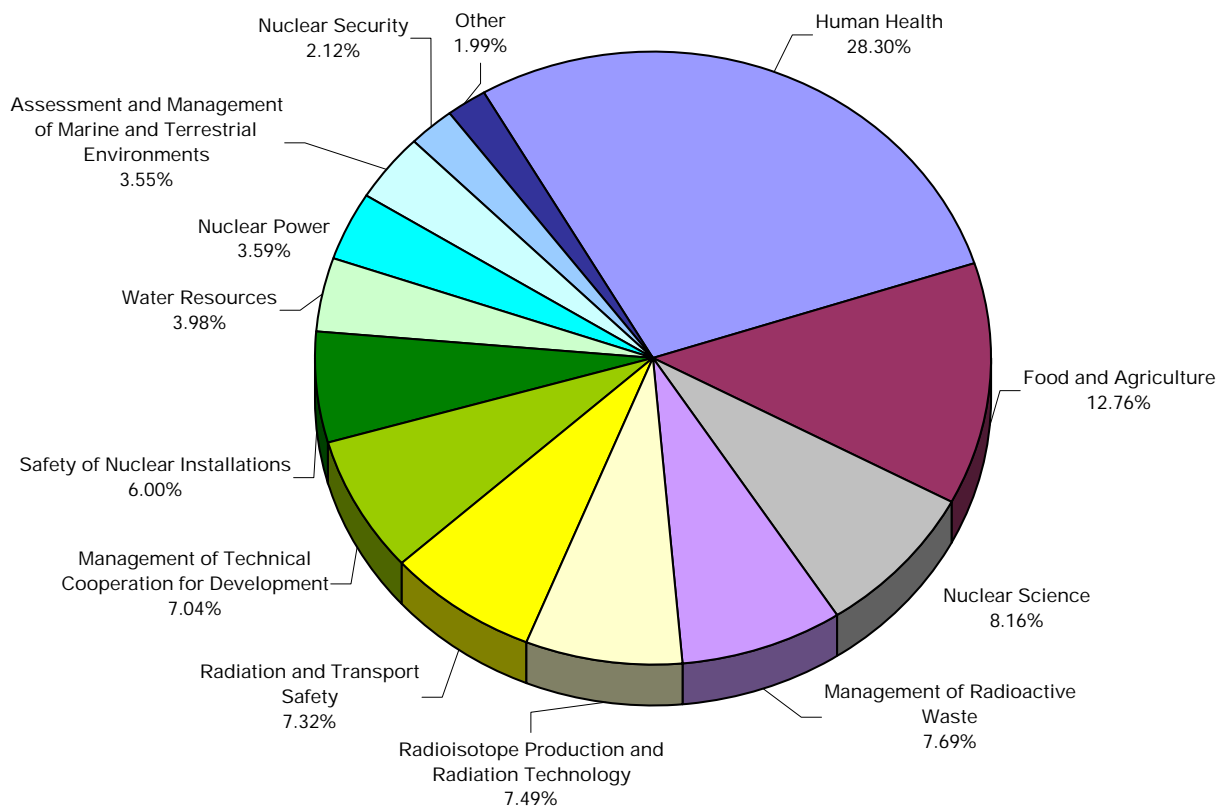


FIG. 2. Distribution of technical cooperation disbursements in 2007 by Agency programme.

Technical Cooperation

The Agency's technical cooperation programme is one of the principal mechanism for implementing the organization's basic mission. Covering all thematic areas of the Agency's activities, and consisting of national, regional and interregional projects, the programme develops human capacity and supports the building of infrastructure to ensure that nuclear technology is used in a safe, secure and peaceful manner.

Technical cooperation projects focus on areas identified by Member States as being of key importance to their development needs. In 2007, human health was the largest single area of the core programme, supporting the use of nuclear techniques for the prevention, diagnosis and treatment of disease, as well as for the improvement of nutrition, particularly of children. The second largest area was food and agriculture, where the objectives were to control insect pests and to improve livestock and crop production, making it more environmentally sustainable. Safety remained a central focus of the programme, with a large number of projects aimed specifically at radiation protection, nuclear installation safety and the safe management of radioactive waste. Water resources,

research reactors and environmental protection were other important areas of activity (Fig. 2).

In Africa, for example, the Agency trained energy planning teams in Burkina Faso, Chad, Côte d'Ivoire, Mauritania and Niger in the preparation of national energy demand reports. In the Asia-Pacific region, the Agency assisted Member States in monitoring and assessing marine radioactivity. Up to 4300 data records on radioactivity levels in seawater, sediment and marine organisms were added to the Global Marine Radioactivity Database, which identified large scale oceanographic circulation processes and established benchmarks on radionuclide concentrations in the marine environment. In Latin America, the Agency's assistance covered training for medical physicists working in radiotherapy centres and delivery of specialized equipment. Twenty-four hospitals received equipment for the positioning and immobilization of patients and a number of centres in each of the participating countries were provided with updated reference material and guidance on the physical aspects of radiotherapy. In Europe, the Agency coordinated fuel repatriation and core conversion projects.

The programme is funded by contributions to the Technical Cooperation Fund (TCF), as well

as through other extrabudgetary contributions, government cost sharing and contributions in kind. Overall, new resources reached a total of around \$100 million in 2007, with approximately \$84 million for the TCF, \$13 million in extrabudgetary resources and about \$3 million representing in-kind contributions. These resources were applied directly to technical cooperation projects.

In 2007, approximately \$94 million was disbursed to over 121 countries. One hundred and sixty training courses were arranged for 2287 participants, 3546 expert missions were organized, 1661 fellows and scientific visitors were trained, and equipment and supplies worth \$47 million were provided.

Verification

A major pillar of the Agency's programme provides assurances to the international community regarding the peaceful use of nuclear material and facilities. The Agency's verification programme thus remains at the core of multilateral efforts to curb the proliferation of nuclear weapons.

At the end of each year, the Agency draws a safeguards conclusion for each State with a safeguards agreement in force, based upon the evaluation of all information available to it for that year. For a 'broader conclusion' to be drawn that 'all nuclear material remained in peaceful activities', both a comprehensive safeguards agreement (CSA) and an additional protocol (AP) must be in force, and the Agency must have been able to conduct all necessary verification and evaluation activities. For States that have CSAs in force but no APs, the Agency does not have sufficient tools to draw safeguards conclusions regarding the absence of undeclared nuclear material and activities. For such States, the Agency draws a conclusion, for a given year, with respect to whether *declared* nuclear material remained in peaceful activities.

For those States for which the broader conclusion has been drawn and a State level integrated safeguards approach has been approved, the Secretariat is able to implement integrated safeguards — the optimum combination of all safeguards measures available to the Agency under CSAs and APs to achieve maximum effectiveness

and efficiency in meeting the Agency's safeguards obligations.

Safeguards conclusions for 2007

In 2007, safeguards were applied for 163 States with safeguards agreements in force with the Agency.⁴ Eighty-two States had both CSAs and APs in force. For 47 of these States,⁵ the Agency concluded that *all* nuclear material remained in peaceful activities. For 15 States this conclusion was drawn for the first time. For 35 of the States, the Agency had not yet completed all the necessary evaluations under their APs, and concluded that the *declared* nuclear material remained in peaceful activities. For 72 States with CSAs in force but without APs, the Agency was able to draw the conclusion that declared nuclear material remained in peaceful nuclear activities.⁶

For three States that had item specific safeguards agreements in force in 2007, the Secretariat concluded that the nuclear material, facilities or other items to which safeguards were applied remained in peaceful activities. Safeguards were also implemented

with regard to declared nuclear material in selected facilities in four of the five nuclear weapon States, all of which have voluntary offer safeguards agreements in force. For these four States, the Agency concluded that nuclear material to which safeguards were applied in selected facilities remained in peaceful activities or was withdrawn as provided for in the agreements.

The Secretariat could not draw any safeguards conclusions for 30 NPT non-nuclear weapon States without safeguards agreements in force.

Integrated safeguards were implemented during 2007 in 14 States, while implementation began in another seven States. In addition, integrated safeguards approaches were developed and approved for five States.

"A major pillar of the Agency's programme provides assurances to the international community regarding the peaceful use of nuclear material and facilities."

⁴ The status with regard to the conclusion of safeguards agreements, APs and small quantities protocols is given in Table A6 in the Annex to this document.

⁵ And Taiwan, China.

⁶ The 72 States do not include the Democratic People's Republic of Korea as the Agency was not able to implement safeguards in that State and, therefore, could not draw any conclusion.

Conclusion of safeguards agreements, additional protocols and small quantities protocols

In 2007, the Secretariat convened an interregional seminar in Vienna for NPT State parties without the required safeguards agreements. Consultations on the amendment of small quantities protocols (SQPs) and the conclusion of APs were held during the year. The Agency also convened regional technical seminars on implementation of APs in Gaborone, Botswana, and in Sydney, Australia.

Additional protocols entered into force for eight States in 2007, bringing the number of States with APs in force to 86. One State concluded a CSA in accordance with its obligation under the NPT. Three States acceded to the safeguards agreement between non-nuclear-weapon States of Euratom, Euratom and the Agency, as well as the AP thereto. A safeguards agreement based on the Tlatelolco Treaty and the protocols thereto entered into force for one State and an item specific safeguards agreement entered into force for another State.

Following a decision by the Board of Governors in 2005, the Agency initiated exchanges of letters with all States having an SQP in order to give effect to the modifications in the standard text and the change in the SQP criteria. During 2007, SQPs were amended to reflect the modified text for four States. An SQP was rescinded and a new safeguards agreement with a modified SQP was concluded. By the end of 2007, there were 69 States with operative SQPs still requiring modification in accordance with the Board's decision.

Verification of nuclear non-proliferation

The issue of nuclear non-proliferation continued to attract the attention of the international community and the media. Following agreement in the 'Six Party Talks' process, the Agency reached agreement with the Democratic People's Republic of Korea on monitoring and verification arrangements related to the shutdown of the Yongbyon nuclear facility and was able to confirm the shutdown status of these installations.

Another verification issue of interest to the international community was the implementation of the NPT safeguards agreement in the Islamic

Republic of Iran and relevant provisions of United Nations Security Council resolutions 1737 (2006) and 1747 (2007). The Agency continued to verify the non-diversion of the declared nuclear material in Iran in 2007. However, the Agency was not in a position to provide credible assurance regarding the absence of undeclared nuclear material and activities in Iran. By the end of 2007, the Agency was able to clarify some of the outstanding safeguards issues relating to Iran's past nuclear activities. Contrary to the decisions of the Security Council, Iran did not suspend its uranium enrichment related activities and continued its heavy water related projects.

Strengthening the effectiveness and improving the efficiency of safeguards

In 2007, further progress was made in strengthening the effectiveness and improving the efficiency of Agency safeguards. Enhancements were made to the implementation of integrated safeguards, the development of safeguards approaches, procedures and technology, cooperation with State and regional systems of accounting for and control of nuclear material, training and quality management.

Research and development activities carried out with the assistance of Member State support programmes are essential to meet the safeguards challenges of the future. An R&D programme for 2008–2009, containing 23 projects in areas such as the development of safeguards concepts, information processing, and analysis, verification technologies and training, was prepared. In addition, meetings and workshops were held to identify tools that would be needed by the Agency to carry out its mission in the future.

The Agency continued to expand its remote monitoring capabilities, which resulted in enhanced effectiveness and efficiency of safeguards implementation. Also, new safeguards approaches based on unannounced inspections for verification of spent fuel transfers allowed savings of approximately 30% in the inspection effort involved in such verifications in 2007.

A special Safeguards Analytical Laboratory (SAL) Study Group, established in 2007 by the Director General, recommended that SAL be reconstructed, advance instrumentation for environmental sample analysis be installed, and the Network of

“Following agreement in the ‘Six Party Talks’ process, the Agency reached agreement with the Democratic People’s Republic of Korea on monitoring and verification arrangements ...”

Analytical Laboratories be further utilized. The Board of Governors expressed its support for independent and timely analysis of safeguards samples and encouraged Member States to provide extrabudgetary support.

Committee 25

A committee established by the Board of Governors to consider ways to strengthen the effectiveness and efficiency of the safeguards system presented its report to the Board in June 2007. Member States reaffirmed their commitment to strengthening the effectiveness and efficiency of the Agency's safeguards system as an important tool for meeting nuclear non-proliferation challenges.

Management Issues

In July, the tenth Senior Management Conference took place. These annual two day meetings have given senior Secretariat staff the opportunity to step back and look at the broader, one-house, picture of the Agency's overall programme and operations. The ultimate purpose has been to bring about improvements in the effectiveness of programme delivery to Member States. The 2007 session focused on the interrelated topics of accountability and risk management. Among the practical outcomes from the conference was the planning of a formal 'foresight' or 'vision' process to produce for Member States more firmly based predictions on the future direction of the programme and the corresponding funding requirements. At year's end, the process was well under way.