

The Year in Review

The Agency, as a multidisciplinary organization, pursues its statutory objective “to seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world” by addressing in a balanced manner the global challenges related to nuclear technology, including energy security, human health and food security, water resources management, nuclear safety and security, and non-proliferation.

NUCLEAR TECHNOLOGY

In the area of nuclear technology, the Agency facilitates the exchange of nuclear information and knowledge, builds capacity, and transfers technology to its Member States, mainly through its technical cooperation programme. The aim is to facilitate, upon request, the use of nuclear science and associated technologies to meet the socioeconomic needs of Member States in a safe, secure and sustainable manner.

Nuclear Power

Status and trends and projected growth for nuclear power

At the end of 2011, there were 435 power reactors in operation with a total capacity of 369 gigawatts-electric (GW(e)), 2% less than at the beginning of the year. The decrease was due to the permanent retirement of 13 reactors. Twelve of the 13 retirements were due to the accident at Tokyo Electric Power Company’s (TEPCO’s) Fukushima Daiichi nuclear power plant (hereinafter referred to as the ‘Fukushima Daiichi accident’) — four reactors at the Fukushima Daiichi plant itself and eight in Germany — and one was the permanent retirement of an old reactor in the United Kingdom. Seven new reactors were connected to the grid, an increase from five new reactors in 2010, two in 2009 and none in 2008.

The Fukushima Daiichi accident resulted in a slowing of the expansion of nuclear power but did not reverse it. The Agency’s post-accident projections of global nuclear power capacity in 2030 were 7–8% lower than what was projected before the accident. Capacity is now expected to grow to 501 GW(e) in 2030 in the low projection and to 746 GW(e) in the high projection. The number of nuclear reactors in

operation in 2030 is expected to increase by about 90 in the low projection. Most of the growth will likely occur in countries that already have operating nuclear power plants, and Member States in Asia as well as the Russian Federation are expected to be the centres of expansion. Of the 64 new power reactors under construction at the end of 2011, 26 were in China, 10 in the Russian Federation, 6 in India and 5 in the Republic of Korea. However, some countries, such as Germany, decided to phase out and discontinue the use of nuclear power.

Other States, such as Belgium, Italy and Switzerland, have re-evaluated their nuclear programmes. Several other countries, such as Austria,

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Denmark, Greece and New Zealand, continued to exclude the nuclear power option.

Agency support to operating nuclear power plants

In the wake of the Fukushima Daiichi accident, assessments for long term operation increased their focus on design review, stored equipment and severe accident management. The Agency expanded the scope of its guidance and assistance for long term operation and initiated an annual ‘Industry Cooperation Forum’, which recommended: increased cooperation with utilities; greater interaction between operating organizations in countries with experience in the nuclear area and those in countries introducing nuclear power; more effective communication; and wider dissemination of best operational practices.

Launching nuclear power programmes

Nuclear power remains an important option for countries, and interest in nuclear power remains high. Of the countries without nuclear power that, before the Fukushima Daiichi accident, had strongly indicated their intention to proceed with a nuclear

power programme, a few cancelled or revised their plans, while others took a 'wait and see' approach, but most continued their programmes to introduce nuclear power. In the Agency's projections, between 7 and 20 new countries are expected to bring their first reactors on-line before 2030.

Some countries that had been strongly committed to nuclear power continued with their plans, incorporating into them the lessons being learned from the Fukushima Daiichi accident. Turkey and the United Arab Emirates (UAE) made progress in 2011 working with vendors. Belarus signed a contract with the Russian Federation for the construction of two reactors. Bangladesh signed an intergovernmental agreement with the Russian Federation for two 1000 MW(e) reactors, and Vietnam signed a loan agreement with the Russian Federation regarding financing of its first nuclear power plant.

The Agency increased assistance especially for new owner/operator organizations in Member States

States. In 2011, the Agency conducted 'Knowledge Management Assist Visits' and workshops in Armenia, Belarus, Bulgaria, China, Kazakhstan, the Republic of Korea, the Russian Federation, Ukraine, the UAE, the USA and Vietnam. The goal was to increase awareness of the importance of knowledge management in the daily operations of nuclear organizations and to help managers, using methods developed by the Agency, to identify the staff positions most critical in terms of knowledge. In cooperation with the Abdus Salam ICTP in Trieste, Italy, the Agency conducted its second Nuclear Energy Management School and seventh Nuclear Knowledge Management School.

Assurance of supply

Several developments occurred in 2011 relating to the assurance of supply of nuclear fuel. The first was an agreement between the Government of the Russian Federation and the Agency that established a low enriched uranium (LEU) reserve in Angarsk, Russian Federation, which entered into force in February. The second involved the Board of Governors' approval, in March 2011, of a 'Nuclear Fuel Assurance' mechanism originally proposed by the United Kingdom and co-sponsored by several other States including some European Union Member States, the Russian Federation and the USA. The third, in May, was the Agency's invitation to interested Member States to submit proposals to host the Agency's LEU Bank that was approved by the Board of Governors in December 2010. Kazakhstan submitted a proposal, an Agency technical mission visited Kazakhstan in August to assess two sites, and negotiations on a host State agreement were scheduled to start in early 2012. By the end of 2011, of the approximately \$150 million pledged as voluntary contributions for the LEU Bank, more than \$105 million had been received by the Agency — from Norway, the USA and the Nuclear Threat Initiative, as well as €10 million from the European Union.

Uranium resources

Agency support for nuclear programmes begins at the very front of the fuel cycle, with estimates and analysis of global uranium resources. Total identified conventional uranium resources recoverable at a cost of less than \$130 per kilogram of uranium (kg U), were estimated at 5.4 million tonnes of uranium (Mt U), with an additional 0.9 Mt U recoverable at costs between \$130 and \$260/kg U. The spot price at the

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while continuing to offer a broad range of support services that included guidance, standards, technical assistance, review services, training, capacity building and knowledge networks. In addition, it conducted Integrated Nuclear Infrastructure Review missions in Bangladesh and the UAE.

Energy assessment services

The Agency helps interested Member States build their capacities for national energy assessments and planning by training experts and transferring computer models and data. Demand for these services continued to increase, and the Agency's analytical tools are now used in over 125 Member States. In 2011, the Agency trained over 600 energy analysts and planners from 67 countries in the use of these tools. Traditional face to face training was regularly supplemented by web based e-training.

Capacity building

The preservation and management of nuclear knowledge is a high priority for many Member

end of the year was \$135/kg U. Uranium production was estimated to have increased by 2.5%, to about 55 500 t U in 2011. Production in Kazakhstan, the world's largest producer, which increased by 27% between 2009 and 2010, was estimated to have increased by another 9% in 2011.

At the 2010 rate of uranium consumption by the world's nuclear power plants, the projected lifetime of 5.4 Mt U is approximately 80 years.

Innovation

Continual innovation is essential for the long term expansion of nuclear power. In 2011, interest continued to increase in small and medium sized reactors and in innovations to mitigate the susceptibility of reactors to extreme natural hazards. The Agency continued to promote the exchange of technical information through Technical Working Groups, CRPs, international conferences, publications and the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO). In a series of workshops, advances and experience in power plant construction were shared with countries considering new reactors, particularly the advantages and disadvantages of different approaches under geographical and resource constraints. The Agency's Power Reactor Information System was expanded to include non-electric applications, and INPRO completed a collaborative project that quantified the benefits of international cooperation in a future global transition to fast reactors and closed fuel cycles. Egypt, Israel and Jordan joined INPRO, increasing the membership to 35.

Research reactors

Research reactor coalitions supported by the Agency were strengthened in 2011 to improve utilization, ageing management and training. A new Central African Research Reactor Network was initiated in July, and three training courses were organized by the Eastern European Research Reactor Initiative. The Agency also contributed to the continuing conversion of research reactors from high enriched uranium (HEU) to LEU. Mexico decided to convert its TRIGA research reactor to LEU fuel and, through the Agency, secured the replacement of its HEU fuel with LEU from the USA. The Agency, under a project designed to assist Mexico with research reactor conversion, completed fuel inspections in France and Mexico in support of the first of two LEU fuel shipments. This fuel was received in Mexico in

December. As part of the Russian Research Reactor Fuel Return programme, a tripartite contract was signed between the Agency, the Russian Federation and Ukraine in October to return the last fresh HEU fuel stockpile at Ukraine's Kharkov Institute to the Russian Federation before March 2012.

Shortages of molybdenum-99 were less of an immediate concern in 2011 following the 2010 restarts of research reactors in Canada and the Netherlands. The Agency shifted its focus to the transition of molybdenum-99 production away from the use of HEU. It completed a comparative assessment of non-HEU production technologies, organized an international meeting to further international collaboration on conversion to LEU based production

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and completed a CRP on production using LEU targets.

Applications of Nuclear Technology

Trends and developments

In 2011, the Agency continued to assist Member States in the application of nuclear and isotopic techniques in the areas of food and agriculture, human health, water resources, the environment and industry as related, in particular, to socioeconomic development and the Millennium Development Goals. Capacity building as a cross-cutting priority for all of the above areas in nuclear applications was strengthened through collaboration and partnership with FAO, WHO, ICTP, UNEP and UNESCO, as well as through networks such as ALMERA¹ and IAEA Collaborating Centres. The Agency's coordinated research activities continued to stimulate research in nuclear fields in Member States through more than 130 active CRPs at the end of 2011. Applied R&D, training and capacity building, and provision of analytical

¹ The ALMERA (Analytical Laboratories for the Measurement of Environmental Radioactivity) network currently represents 122 laboratories from 77 countries worldwide (<http://www.iaea.org/nael/page.php?page=2244>).

services to Member States were strengthened at the Agency's laboratories in Seibersdorf and Monaco, thus increasing the impact of Agency programmes in food and agriculture, human health, isotope hydrology and environmental monitoring.

Food and agriculture

Rinderpest, also known as cattle plague, is a highly contagious viral disease of cattle, buffalo, yak and several wildlife species that has caused immense livestock losses over many decades. The Agency, in collaboration with FAO, the World Organisation for Animal Health (OIE) and other partners, has supported Member States for more than 25 years in their efforts to control and eradicate the disease. In early 2011, FAO and OIE officially declared the

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disease eradicated from the world. This significant event was marked by a special celebration on 21 September during the Agency's 55th regular session of the General Conference.

In 2011, the Agency's coordinated research activities resulted in the adoption of 14 irradiation treatments pertaining to plant health and control of quarantine pests under the International Plant Protection Convention to facilitate trade in agricultural commodities such as tropical fruits. Guidelines on the audit and accreditation of facilities that irradiate food were also developed by the Asia and Pacific Plant Protection Commission for adoption as a regional standard.

Human health

A mobile version of the 'Human Health Campus', an educational distance learning web site for health professionals in radiation medicine (<http://humanhealth.iaea.org>) was launched, providing e-learning modules, case studies, audiovisual tutorials and interactive sessions in nuclear medicine, radiation oncology, medical physics and nutrition (<http://humanhealth.iaea.org/M>). This provides a

platform for capacity building, in addition to the interactive on-line learning offered by the Human Health Campus.

The Agency continued to emphasize the importance of quality assurance, encouraging Member States to commit to a peer review and educational process. It continued its train the trainer activities for quality management courses, organizing Quality Assurance in Nuclear Medicine (QUANUM) missions as well as conferences, meetings and publications.

An international conference on 'Clinical PET and Molecular Nuclear Medicine' (IPET-2011) was convened in Vienna in November. The current status, challenges and future directions in clinical nuclear medicine were discussed, with an emphasis on oncology, neurology, cardiology and infection, from the 'laboratory to the bedside'.

The Agency continued its efforts to raise awareness of the usefulness of stable isotope techniques in programmes designed to promote good nutritional practices. To assist in this process, the first five e-learning modules on stable isotope techniques in nutrition were launched, and a number of Agency publications on this subject were issued.

Programme of Action for Cancer Therapy (PACT)

In 2011, the Political Declaration of the High-level Meeting of the United Nations General Assembly on the Prevention and Control of Non-communicable Diseases (NCDs) formally recognized the Agency's role in the fight against NCDs, particularly cancer and heart diseases. This invigorated its cancer initiatives and enhanced its collaboration with WHO and other United Nations agencies.

Support for cancer control was intensified, as reflected in Member State requests for integrated missions of PACT (imPACT) reviews and support for the Agency's Advisory Group on Increasing Access to Radiotherapy Technology (AGaRT) in low and middle income (LMI) countries. This support included donations of more than \$1 million in contributions and pledges from partner organizations and Member States.

AGaRT continues to act as a facilitator to bring together radiotherapy users in LMI countries and major radiotherapy equipment suppliers, to ensure that the unique radiotherapy service requirements of these countries are met by the technology available. During the second AGaRT meeting, in June 2011, discussions on guidelines were initiated to balance

medical, technical and economic aspects when selecting equipment for a radiotherapy unit.

Radioisotopes and radiation technology

Applications of radioisotopes in diagnosis and therapy continued to grow. A CRP on ‘Therapeutic Radiopharmaceuticals Labelled with Rhenium-188 and Yttrium-90’ was concluded, while another CRP was initiated to develop an easy to use, freeze-dried kit for the treatment of non-Hodgkin’s lymphoma, a type of blood cancer. A major goal was to facilitate the availability of radiolabelled antibodies at reasonable cost to Member States.

In diagnosis, a CRP on ‘Accelerator Based Alternatives to non-HEU Production of Molybdenum-99/Technetium-99m’ was initiated to help Member States make use of an alternate technology using accelerators to produce technetium-99m, a key diagnostic radiopharmaceutical in nuclear medicine. Gallium-68, available from a generator, was the focus of another CRP to help Member States carry out studies using positron emission tomography without an on-site cyclotron.

Through its technical cooperation programme, the Agency installed a cobalt-60 source in Cuba.

Environment

The Agency strengthened its research activities to monitor radionuclides in the marine and terrestrial environment and to study climate change issues in the oceans – in particular, to study the impact of ocean acidification and global warming on oceanographic processes, ecosystems and associated services. Three new marine certified reference materials for radionuclides, trace elements and organic contaminants were produced according to ISO guides 34 and 35 and distributed to Member States. In addition, the Agency implemented 28 technical cooperation projects to assist over 40 Member States in Africa, the Middle East, the Asia-Pacific region, and Latin America and the Caribbean to develop or to improve national technical and equipment capacity for marine pollution studies and environmental quality assessment.

Management of water resources

The Agency’s Global Network of Isotopes in Precipitation, managed in collaboration with the World Meteorological Organization, has been the primary global database since 1961 for isotope

applications in hydrology and climate studies. An atlas of isotopes in river waters was completed to aid Member State efforts to monitor the hydrological impacts of climate change, as rivers integrate the spatial and temporal changes in precipitation, water use and land use patterns in a catchment.

Increasing use of groundwater, in part to mitigate the impact of climate change, requires a better understanding of aquifer recharge, for which isotopes of noble gases are a powerful tool. In this context, a portable sampling device for dissolved noble gases was developed in 2011 that allows wider use of isotopes for climate change adaptation studies. The work of the Agency in this area was featured in an article in *The New York Times* in November 2011.

The Agency’s Water Availability Enhancement Project (IWAVE), supported by the Peaceful Uses Initiative (PUI), was successfully launched in three pilot countries, Costa Rica, Oman and the Philippines. As the first step in this project, detailed reports on the information needed are being prepared in each Member State. The first of the reports for the Philippines was completed in 2011.²

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An international symposium on ‘Isotope Hydrology, Marine Ecosystems, and Climate Change Studies’ organized by the Agency in Monaco addressed the role of isotopes in understanding and modelling climate change, marine ecosystems and water cycles. The special focus on water resource assessments emphasized the strong link between the application of nuclear and isotope techniques, water resource management and policy decisions.

NUCLEAR SAFETY AND SECURITY

The Agency’s nuclear safety and security programmes promote the worldwide achievement

² BARRINGER, F., A rare isotope helps track an ancient water source, *The New York Times*, 22 November 2011, p. D2.

GENERAL CONFERENCE SCIENTIFIC FORUM: 'WATER MATTERS'

During the 55th regular session of the General Conference in September, a two day Scientific Forum entitled 'Water Matters: Making a Difference with Nuclear Techniques' highlighted the importance of water on the international agenda and the role that nuclear techniques play in addressing key water and climate issues. The Director General opened the event, introducing the Agency's activities and role in the effective management of water resources.

Over the two days, government ministers joined leading water experts from the fields of agriculture, hydrology and oceanography to highlight global water challenges and to demonstrate the benefits of nuclear techniques in addressing these issues.

The Forum highlighted the need for scientific information on water resources in order to adopt sound management policies. It also emphasized the contribution that new technologies — both isotope and non-isotope — can make in addressing the technical, socioeconomic and political water related challenges that will be faced by the world's population in the future.

The importance of agricultural water management to address food security and sustainable agriculture was addressed in a session on 'Tackling Water Scarcity and Saving Water in Agriculture', which underlined the need for better management of water in both rainfed and irrigated agriculture. This was essential to cover the expected 50% increase in global agriculture water requirements by 2050 to meet additional demand for food for a global population that is expected to grow from the current 7 billion to around 9 billion by 2050.

of high levels of nuclear safety and nuclear security to protect people, society and the environment.

In response to the Fukushima Daiichi accident, the Agency convened a five day Ministerial Conference on Nuclear Safety in Vienna from 20 to 24 June 2011. The objective of the conference was to learn lessons from the accident and strengthen nuclear safety throughout the world. At the conference, a Ministerial Declaration was adopted which, inter alia, requested the Director General to prepare a draft Action Plan on Nuclear Safety. The Action Plan was approved by the Board of Governors and endorsed unanimously by the 55th regular session of the General Conference in September. This plan provides a comprehensive

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framework of actions to strengthen global nuclear safety. An initial progress report in the implementation of the Action Plan was submitted to the Board of Governors in November 2011.

Status of Nuclear Safety

Despite the Fukushima Daiichi accident, the level of nuclear safety among the 435 operating nuclear power plants in operation around the world remained high in 2011, as indicated by data collected by the Agency and the World Association of Nuclear Operators.

Conventions and Codes of Conduct

In April 2011, Contracting Parties to the Convention on Nuclear Safety (CNS) met in Vienna for the Fifth Review Meeting. The CNS agreed, inter alia, to analyse relevant issues of arising from the Fukushima Daiichi accident at an Extraordinary Meeting to be held in August 2012.

An international meeting on the Code of Conduct on the Safety of Research Reactors was held in May 2011 with the participation of 31 countries. The meeting participants recognized the efforts of the Agency in encouraging Member States to apply the Code. At the meeting, it was concluded that the Code is the principal reference of Member State activities in the area of research reactor safety and provides recommendations to address common safety issues such as regulatory supervision and ageing management.

Safety standards

The IAEA Action Plan on Nuclear Safety requested the Commission on Safety Standards (CSS) and the Secretariat to review and revise the relevant safety standards in a prioritized sequence, as required, using the existing process in a more efficient manner.

The first draft of an action plan for the review of the Agency's safety standards was prepared by the Secretariat and submitted to the CSS at its meeting in November 2011. The draft plan describes the methodology for conducting the review of the safety standards in terms of scope, prioritization, approach, process and timeline, as well as possible options for subsequent revisions of those safety standards where necessary. The Agency offers a range of support services to Member States intending to embark on a nuclear power programme. For example, a new Safety Guide published in 2011, *Establishing the Safety Infrastructure for a Nuclear Power Programme* (IAEA Safety Standards Series No. SSG-16), provides recommendations on how countries can meet the Agency's Safety Requirements for national safety infrastructures. This publication was used in conjunction with workshops, training seminars and self-assessment tools.

Peer reviews and advisory services

The Agency continued to assist States in applying its safety standards and security guidance by providing education and training, promoting information exchange on best safety practices, and rendering a broad range of safety services. The nuclear safety and security services offered by the Agency — such as operational safety reviews, design reviews and regulatory reviews — continued to be in great demand.

For example, nine Integrated Regulatory Review Service (IRRS) missions were conducted in 2011, more than in any previous year. Of these nine, five were first missions, to the Republic of Korea, Romania, Slovenia, Switzerland and the UAE, and four were follow-up missions to Australia, Canada, Germany and Spain.

The Agency's Operational Safety Review Team (OSART) missions are a well-known and important service for nuclear power plants. In 2011, seven OSART missions were conducted: in Armenia, Brazil, the Czech Republic, France, the Russian Federation, South Africa and the USA. In addition,

following the Fukushima Daiichi accident, severe accident management was added as an OSART module to further support the enhancement of nuclear safety in Member States.

The Integrated Safety Assessment for Research Reactors (INSARR) service is designed to enhance the safety of research reactors and for promoting the application of the Agency's safety standards. Three INSARR missions were conducted in 2011: to the High Flux Reactor in Petten, the Netherlands, which produces 40% of the world's supply of the medical radioisotope molybdenum-99; to the TRIGA reactor in Pitești, Romania; and to the 10 MW Huarangal research reactor in Peru.

Following the Fukushima Daiichi accident, the Design and Safety Assessment Review Service was enhanced to identify the impact of extreme events on fundamental safety functions and to develop possible mitigating actions.

There was increased demand for site selection, site assessment and hazard characterization review services by Member States. Nine Siting and External Event Design reviews were conducted in 2011 in Armenia, Bangladesh, Indonesia, Jordan, Malaysia, Morocco, Romania, the UAE and Vietnam. These review services highlighted the continued need for Member States to carry out thorough site specific

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hazard and design safety reviews consistent with the Agency's safety standards to protect nuclear installations against external hazards.

By the end of 2011, 80% of the 435 nuclear power plants operating in the world were more than 20 years old. The Agency conducted peer review missions under its Safe Long Term Operation service in the Czech Republic, Hungary, the Republic of Korea, the Netherlands, Pakistan, South Africa and Ukraine.

At the request of the Malaysian Government, the Agency organized an expert mission to review the radiation safety aspects of a rare earth processing facility being built near Kuantan, in Pahang state, against Agency safety standards and to draw the relevant conclusions.

Global knowledge networks

The Regulatory Cooperation Forum (RCF) is a Member State initiative that optimizes regulatory support from Member States with advanced nuclear power programmes to States considering nuclear power or initiating a nuclear power programme ('newcomer countries'). In 2011, the RCF, facilitated and promoted by the Agency, developed and implemented an action plan for Jordan's regulatory body and identified Vietnam and Poland as the next recipients of RCF activities.

Research, education and training

The Agency further developed its Safety Assessment Education and Training (SAET) project. The training programmes were structured for the specific needs of Member States, based on the SAET syllabus and related safety assessment training modules. This training is available to Member States

"In 2011, the Board of Governors approved ... Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards – Interim Edition ..."

through the technical cooperation programme, as well as through extrabudgetary funding.

Strengthening the safety of radioactive sources

The revised *Guidance on the Import and Export of Radioactive Sources* was approved by the Board of Governors and the General Conference in 2011. In July 2011, the Agency organized a meeting on the Code of Conduct on Safety and Security of Radioactive Sources to discuss implementation of the Code. As a result of this meeting, additional States expressed their commitment to use the Code of Conduct as guidance in the development and harmonization of their national laws and regulations, bringing the total number of States making this commitment to 107 as of December 2011.

Revised Basic Safety Standards for Radiation Protection and the Safety of Radiation Sources

In 2011, the Board of Governors approved a Safety Requirements publication entitled *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards – Interim Edition* (IAEA Safety Standards Series No. GSR Part 3 (Interim)). This interim edition, which was published in November, is consistent with the 2007 recommendations of the International Commission on Radiological Protection and reflects developments since the 1996 edition in the protection of workers and the public, and in relation to medical exposures.

Decommissioning

Hundreds of facilities around the world using radioactive and nuclear material are ageing and many will soon reach the end of their projected operational lifetime. A number of operating facilities are being shut down earlier than initially planned. In the short term, this is not expected to significantly increase the number of facilities undergoing immediate dismantling. Instead, many of these facilities are likely to be placed into safe enclosure awaiting deferred dismantling. However, an increased need is expected in Member States for decommissioning resources, both technical and financial. This will result in turn in an increased demand for the Agency's assistance and services.

Denials of shipment

Reporting of denials of shipment of radioactive material remains sporadic and, as a result, the extent of the problem remains difficult to identify with precision. A revised reporting process was developed which will be implemented in 2012 to improve the quality of reporting. Reducing denials to a level that is no longer of significant concern by the 2013 General Conference continues to be a goal. In this connection, participants at the Agency's international conference on the 'Safe and Secure Transport of Radioactive Material: The Next Fifty Years of Transport – Creating a Safe, Secure and Sustainable Framework', held in October 2011, identified the need to increase support for Member States in the area of denials of shipment.

Incident and emergency preparedness and response

The Agency continued to contribute to the strengthening of global emergency preparedness and response arrangements and capabilities. Shortly after the notification of Japan's International Seismic Safety Centre, the Agency's Incident and Emergency system was activated and its Incident and Emergency Centre (IEC) was placed in 'full response' mode. Since then, the Agency's efforts in 2011 were focused on the response to the Fukushima Daiichi accident. Many lessons have been identified nationally as well as internationally, and these will be taken into account in the future.

Civil liability for nuclear damage

The *IAEA Action Plan on Nuclear Safety* calls specifically for States to work towards the establishment of a global nuclear liability framework that addresses the concerns of all States that might be affected by a nuclear accident, with a view to providing appropriate compensation for nuclear damage, and calls on the Agency's International Expert Group on Nuclear Liability (INLEX) to recommend actions to facilitate the achievement of such a goal.

At its 11th regular meeting, held in May 2011, INLEX discussed, inter alia, developments relating to nuclear liability with the European Union and INLEX's outreach activities. At a special session held in December 2011, INLEX discussed inter alia its role in the implementation of the *IAEA Action Plan on Nuclear Safety*. In particular, the Group agreed on activities to be carried out before the next regular meeting in May 2012, and had a preliminary discussion on ways and means whereby a global nuclear liability framework that addresses the concerns of all States can be established.

Status of Nuclear Security

The risk of nuclear and other radioactive material being used with malicious intent poses a serious threat to international peace and security. In 2011, the Agency continued to help States in establishing and sustaining effective national security frameworks. Support was given in: meeting commitments under the relevant international legal instruments; the establishment of international guidance; capacity building; the conduct of peer reviews; and the enhancement of international cooperation.

The International Nuclear Security Education Network provides a forum for the Agency and academic and research bodies to collaborate in the area of educational activities dealing with nuclear security. Using the Agency's guidance material, five universities in Europe began development of Master of Science programmes in nuclear security for the autumn 2012 semester. This initiative is being supported by the Agency and the European Commission.

The Agency continued to interact with Member States and relevant United Nations bodies such as the Counter-Terrorism Implementation Task Force and the United Nations Security Council Resolution 1540 Committee (the '1540 Committee'). The aim was to improve cooperation and enhance dialogue among other international nuclear security related initiatives.

The Agency conducted three International Physical Protection Advisory Service missions, in France, Sweden and the United Kingdom. Two of

"The International Nuclear Security Education Network provides a forum for the Agency and academic and research bodies to collaborate in the area of educational activities dealing with nuclear security."

these missions took place in States with advanced nuclear programmes, representing a welcome development. The missions identified good practices and made a number of recommendations.

SAFEGUARDS

The Agency's verification programme remains at the core of multilateral efforts to curb the proliferation of nuclear weapons. Through the application of safeguards, the Agency aims to assure the international community that nuclear material and facilities are used only for peaceful purposes. As such, the Agency has an essential verification role under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), as well as other treaties such as those establishing nuclear-weapon-free zones.

Implementation of Safeguards in 2011

At the end of each year, based upon an evaluation of all safeguards relevant information available to it for that year, the Agency draws a safeguards conclusion for each State for which safeguards are applied. In 2011, safeguards were applied for 178 States³ with safeguards agreements in force with the Agency.^{4,5}

For the Agency to be able to conclude that all nuclear material in a State remained in peaceful activities, both a comprehensive safeguards agreement (CSA) and an additional protocol (AP) should be in force, and the Agency must have been able to conduct all necessary verification and evaluation activities. By the end of 2011, of the 109 States with both a CSA and AP in force, the Agency was able to draw such a conclusion for 58 of these States.⁶ For the other 51 States, the Agency was only able to conclude that *declared* nuclear material remained in peaceful activities, as all the necessary evaluations had yet to be completed.

For the 61 States with a CSA but with no AP in force, the Agency was only able to conclude that *declared* nuclear material remained in peaceful

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activities, as the Agency did not have sufficient tools to provide credible assurances regarding the absence of *undeclared* nuclear material and activities.

Safeguards were also implemented with regard to declared nuclear material in selected facilities in the five nuclear-weapon States under their

³ The 178 States do not include the Democratic People’s Republic of Korea, where the Agency did not implement safeguards and, therefore, could not draw any conclusion.

⁴ And Taiwan, China

⁵ The status with regard to the conclusion of safeguards agreements, APs and small quantities protocols is given in the annex to this document.

⁶ And Taiwan, China.

respective voluntary offer agreements and APs. For these States, the Secretariat concluded that nuclear material to which safeguards had been applied in selected facilities remained in peaceful activities or had been withdrawn from safeguards as provided for in the agreements.

For the three States in which the Agency implemented safeguards pursuant to safeguards agreements based on INFCIRC/66/Rev.2, the Secretariat concluded that the nuclear material, facilities or other items to which safeguards were applied remained in peaceful activities.

The Secretariat could not draw any safeguards conclusions for the 14 NPT non-nuclear-weapon States without safeguards agreements in force.

During 2011, the Director General submitted four reports to the Board of Governors on the implementation of the NPT Safeguards Agreement and relevant provisions of United Nations Security Council resolutions in the Islamic Republic of Iran (Iran). While the Agency continued throughout 2011 to verify the non-diversion of declared nuclear material at the nuclear facilities and locations outside facilities declared by Iran under its Safeguards Agreement, as Iran did not provide the necessary cooperation, including by not implementing its Additional Protocol, as required in the binding resolutions of the Board of Governors and the United Nations Security Council, the Agency was unable to provide credible assurance about the absence of undeclared nuclear material and activities in Iran and, therefore, was unable to conclude that all nuclear material in Iran was in peaceful activities. The Director General decided that the time was right to provide the Board of Governors with the Secretariat’s detailed analysis of the information available to the Agency which had given rise to concerns about possible military dimensions to Iran’s nuclear programme. This analysis was published in an Annex to the Director General’s November 2011 report to the Board. The Secretariat’s analysis indicates that Iran has carried out activities relevant to the development of a nuclear explosive device. It also indicates that prior to the end of 2003, these activities took place under a structured programme and that some activities may still be ongoing. On 18 November 2011, the Board of Governors adopted by a vote resolution GOV/2011/69 in which, inter alia, the Board expressed deep and increasing concern about the unresolved issues regarding the Iranian nuclear programme, including those which need to be clarified to exclude the existence of possible military dimensions, and stressed that it is essential

for Iran and the Agency to intensify their dialogue aiming at the urgent resolution of all outstanding substantive issues for the purpose of providing clarifications regarding those issues, including access to all relevant information, documentation, sites, material and personnel in Iran.

During 2011, the Director General submitted two reports to the Board of Governors on the implementation of the NPT Safeguards Agreement in the Syrian Arab Republic (Syria). On 6 June 2011, the Director General reported to the Board of Governors that, based on all the information available to the Agency, it was very likely that a building destroyed at the Dair Alzour site was a nuclear reactor which should have been declared to the Agency by Syria. On 9 June 2011, the Board of Governors adopted by a vote a resolution in which it, inter alia, decided to report, as provided for in Article XII.C of the Statute, through the Director General, Syria's non-compliance with its Safeguards Agreement to all Members of the Agency and to the Security Council and General Assembly of the United Nations. In May 2011, Syria indicated its readiness to fully cooperate with the Agency to resolve issues related to the Dair Alzour site. Following that, in August 2011, Syria informed the Agency of its readiness to have a meeting with the Agency in order to resolve the outstanding issues regarding the Dair Alzour site. In October 2011, a delegation from the Agency visited Damascus with the aim of advancing the Agency's verification mission in Syria. A number of questions, in particular concerning other locations that may be functionally related to the Dair Alzour site, remain to be resolved. In 2011, Syria cooperated with the Agency in addressing the Agency's concerns in relation to previously unreported conversion activities at the Miniature Neutron Source Reactor and the origin of anthropogenic natural uranium particles found there. The Agency decided that the matter would henceforth be addressed in the routine implementation of safeguards. For 2011, the Agency was able to conclude for Syria that declared nuclear material remained in peaceful activities.

Since December 2002, the Agency has not implemented safeguards in the Democratic People's Republic of Korea (DPRK) and, therefore, did not draw any safeguards conclusion for that country. In September 2011, the Director General submitted a report to the Board of Governors and General Conference on the application of safeguards in the DPRK. Since 1994, the Agency has not been able to conduct all necessary safeguards activities provided for in the DPRK's NPT Safeguards Agreement.

From the end of 2002 until July 2007, the Agency was not able, and since April 2009 has not been able, to implement any verification measures in the DPRK and, therefore, could not draw any safeguards conclusion regarding the DPRK. Reports received about the construction of a new uranium enrichment facility and of a light water reactor in the DPRK are deeply troubling. Although not implementing any verification activities in the field, the Agency continued to monitor the DPRK's nuclear activities by using open source information, satellite imagery and trade information. The Agency also continued to further consolidate its knowledge

"The Secretariat continued to implement its Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols ..."

of the DPRK's nuclear programme with the objective of maintaining operational readiness to resume safeguards implementation in the DPRK.

Conclusion of Safeguards Agreements and Additional Protocols

The Secretariat continued to implement its *Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols*, which was updated in September 2010. Outreach events in 2011 included: an interregional seminar on the Agency's safeguards system for States in Southeast and South Asia with limited nuclear material and activities; a regional seminar on the Agency's safeguards system for States in Southeast Asia with significant nuclear activities (both held in Singapore in March 2011); and briefings for a number of Permanent Missions on the Agency's safeguards (in Geneva in May and in New York in October).

In 2011, CSAs entered into force for three States and APs for ten States. Small quantities protocols that reflect the revised text were brought into force in seven States.

Strengthening Safeguards

In 2011, the Agency prepared to implement the Agency's *Medium Term Strategy 2012–2017* and the *Long-Term Strategic Plan 2012–2023* for safeguards.

The Agency continued to evolve the State level concept for the planning, conduct and evaluation of safeguards. Safeguards implementation, pursued in accordance with the State level concept, is based on a comprehensive evaluation of all safeguards relevant information regarding a State. Efforts during the year focused on ways to better link verification activities at Headquarters and in the field with those related to the evaluation of all safeguards relevant information available to the Agency. All such information regarding a State's nuclear programme, including feedback from inspection related activities, is evaluated, not only to draw

“The construction at the Agency's Seibersdorf Laboratories of an extension to the Clean Laboratory for environmental sample particle analysis was completed, and advanced mass spectrometry equipment was put into service.”

safeguards conclusions but also to determine the safeguards activities to be conducted with respect to that State in order to maintain those conclusions. This helps the Agency to customize and focus its verification activities.

To help States build their capacity to comply with their safeguards obligations, in 2011 the Agency conducted two IAEA SSAC Advisory Service (ISSAS) missions in Kazakhstan and Mexico, as well as seven international, regional and national training courses for personnel implementing systems to comply with the obligations.

A project entitled 'Enhancing Capabilities of the Safeguards Analytical Services (ECAS)' achieved significant progress. The construction at the Agency's Seibersdorf Laboratories of an extension to the Clean Laboratory for environmental sample particle analysis was completed, and advanced mass spectrometry equipment was put into service. Site preparation began for the construction of the new Nuclear Material Laboratory, and progress was made in the concept and design for infrastructure and site reorientation required in order to improve the efficiency and security of the Agency's Safeguards Analytical Laboratories.

MANAGEMENT OF TECHNICAL COOPERATION FOR DEVELOPMENT

The Agency carries out its mandate “to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world” primarily through its technical cooperation programme. Its contribution in addressing a range of socioeconomic and development issues is carefully targeted. Technical cooperation projects, whether on nuclear power, knowledge management, human health, better water management, more accurate identification of pollution sources, or nuclear safety or security, help Member States deal with important challenges.

In 2011, the technical cooperation programme was carried out against a global development backdrop that included the Millennium Development Goals and the approaching 2015 deadline for their achievement; international concern about climate change; and other pressing challenges such as water scarcity, land degradation, food and energy security, and communicable and non-communicable diseases. The 'Green Economy' concept, defined by UNEP as an economy that is low carbon, resource efficient and socially inclusive, continued to gain momentum, and with the United Nations Conference on Sustainable Development (Rio+20) in sight, sustainable development issues were at the forefront of the development agenda.

In response to Member State requests, the Agency continued to focus on improving programme quality and transparency. Training to ensure that all technical cooperation project objectives would be specific, measurable, attainable, realistic, and timely was carried out for programme management officers, National Liaison Officers and technical officers, and was completed in early 2011. Cross-cutting efforts were made to ensure early review of the 2012–2013 technical cooperation programme cycle. In addition, special efforts were made to ensure that Member States received information in a timely fashion, through informal briefings, seminars, and the early release of documentation for the meeting of the Technical Assistance and Cooperation Committee.

Since the Agency's contribution to Member State development is specialized and technical in nature, partnerships with relevant actors, from counterparts to other international organizations, are essential if the programme is to meet its strategic goal of promoting tangible socioeconomic impact in Member States by contributing to the achievement

of their sustainable development priorities. In recent years, the Agency has made a particular effort to participate in the United Nations Development Assistance Framework (UNDAF) process and to build on complementarities with other international and regional development agenda.

Specific partnerships in 2011 included cooperation with the UNDP in Asia to promote nuclear imaging technologies, coordinated support with several United Nations agencies and international partners to address the legacy of uranium production sites in Europe, joint activities with the Pan American Health Organization to increase the use of nuclear applications in medicine, and efforts to enhance institutional collaboration and synergies with the African Union Commission's Department of Peace and Security. Significant support to nuclear safety activities was provided under an agreement with the European Commission.

The Technical Cooperation Programme in 2011

In 2011, the nuclear fuel cycle programme accounted for the highest proportion of 'actuals' through the technical programme, at 27%.⁷ It was followed by human health at 18.3%, and by nuclear safety at 16.1% (Fig. 1). By the end of the year, financial implementation of the Technical Cooperation Fund (TCF) stood at 73.9%. Regarding non-financial implementation, the technical cooperation programme supported, inter alia, 3319 expert and lecture assignments, 205 training courses and 1379 fellowships and scientific visits.

At the regional level, meeting basic human needs remained at the top of the agenda for national development plans and international cooperation programmes in many African Member States. Agency assistance in this region therefore focused mainly on the sustainable application of nuclear techniques to achieve increased food security, improved nutrition and health services. In addition, attention focused on better management of groundwater resources, improved energy development planning, quality control in industrial development and a cleaner and safer environment.

⁷ The financial terminology has changed following implementation of a new enterprise resource planning system, the Agency-wide Information System for Programme Support. 'Actuals' are the equivalent of 'disbursements', which was the term used previously.

In Asia and the Pacific, the focus on strengthening human and institutional capacity to apply nuclear technology in the health, agriculture and industry sectors continued. Other areas of activity included support to infrastructure building for Member States embarking on nuclear power programmes, and developing and strengthening national infrastructure for radiation and nuclear safety.

Acting promptly in response to a request from Member States following the Fukushima Daiichi accident, the Secretariat coordinated the initiation of a new RCA project to enhance national capacities for monitoring radioactive substances in the marine environment in the Asia and the Pacific region. The project aims to harmonize measurements of various radioisotopes to ensure a comparable and verifiable impact assessment across the Pacific Ocean, as well as exchange of information about the potential impact and risks to marine biota and to humans through food consumption. In addition to RCA Member States, seven other countries from the region are participating in this project, including three that are not Agency Member States.

"Training to ensure that all technical cooperation project objectives would be specific, measurable, attainable, realistic and timely was carried out ... in early 2011."

In Europe, technical cooperation activities concentrated on support for countries planning a nuclear power programme, and on the use of radiation in health care. Ensuring that appropriate levels of safety and security in all aspects of the peaceful use of nuclear technology are maintained is a key component of the Agency's technical cooperation projects.

In Latin America, special emphasis was placed on promoting technical excellence, leadership and cooperation between Member States, particularly through trilateral cooperation arrangements within regional projects planned for the 2012–2013 technical cooperation programme cycle. There is a renewed interest in the region in promoting strategic alliances and partnerships to multiply the benefits of technical cooperation with Member States.

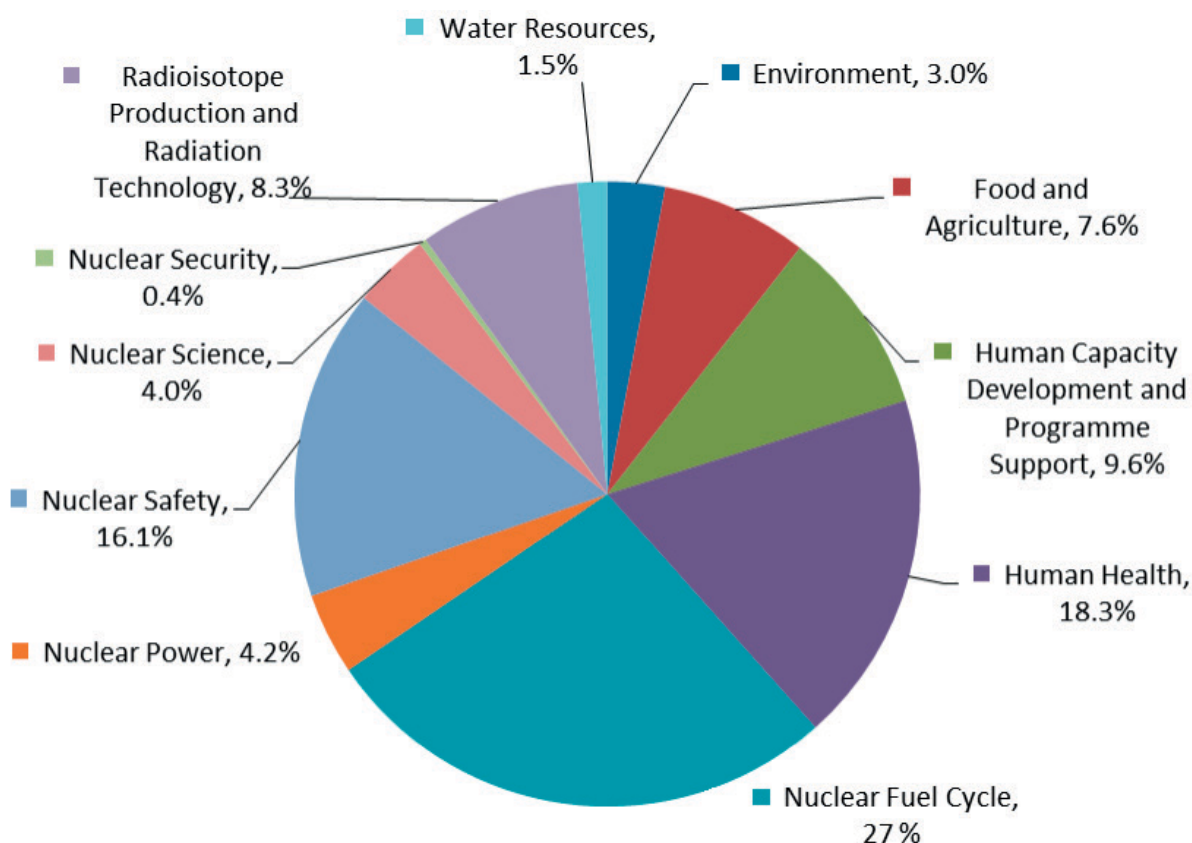


FIG. 1. Actuals by technical field for 2011 (nuclear safety includes transport safety and safe management of radioactive waste; nuclear fuel cycle includes predisposal and disposal of nuclear fuel waste).

Financial Resources of the Technical Cooperation Programme

The technical cooperation programme is funded by voluntary contributions to the TCF, as well as by extrabudgetary contributions, government cost-sharing and contributions in kind. Overall, new resources reached a total of some €81.8 million in 2011, with approximately €62.9 million for the TCF (including previous year payments to the TCF, assessed programme costs, national participation costs⁸ (NPCs) and miscellaneous income), €17.7

“the Secretariat coordinated ... a new RCA project to enhance national capacities for monitoring radioactive substances in the marine environment in the Asia and the Pacific region.”

⁸ National participation costs: Member States receiving technical assistance are assessed a charge of 5% of their national programme, including national projects and fellows and scientific visitors funded under regional or interregional activities. At least half of the assessed amount for the programme must be paid before contractual arrangements for the projects can be made.

million in extrabudgetary resources, and about €1.1 million representing in-kind contributions.

The rate of attainment⁹ for the TCF stood at 89.3% on pledges and at 86% on payments at the end of 2011, while payment of NPCs totalled €0.2 million. Resources were sufficient to carry out the core technical cooperation programme as planned for 2011.

Actuals

In 2011, approximately €83.3 million were disbursed to 123 countries or territories, of which 30 were least developed countries, reflecting the Agency's ongoing effort to address the development needs of those States.

⁹ The rate of attainment is the percentage that results from dividing the total voluntary contributions pledged and paid to the TCF for a particular year by the TCF target for the same year. As payments can be made after the year in question, the rate of attainment can increase over time.

MANAGEMENT ISSUES

In order to strengthen policy planning and strategy formulation as well as improve policy coordination and implementation, the Director General consolidated various high level management functions into a new office, the Director General's Office for Policy. This reorganization was aimed at improving effectiveness and efficiency in addressing current and emerging priority issues as well as cross-cutting and thematic issues so as to ensure a 'one-house' approach within the Secretariat. Another goal was to enhance communication with Member States.

The Agency recognizes that it operates in a challenging environment and is exposed to threats that may have implications for its performance and reputation. It also regards risk management as an essential element in the framework of good corporate governance and as an integral part of good management practice. To address this issue, a systematic approach to risk management was put in place with the objective of adding value to decision making and providing assurance to stakeholders that important risks for the Agency are appropriately dealt with. Specifically, a cross-departmental Risk Management Group was set up in 2011 to address and mitigate identified risks to the work of the Agency.

The formulation of the 2012–2013 programme and budget was guided by the goals of maximizing efficiency, reflecting changing priorities, striking an appropriate balance among the Agency's activities and, at the same time, taking into account the current financial challenges faced by most Member States and constantly increasing demands for the

Agency's services. A two stage budget preparation process using a new methodology was initiated that also considered the guidance given to the Secretariat by Member States and the priorities identified in the *Medium Term Strategy 2012–2017*.

Among the Agency's initiatives to improve efficiency, effectiveness and organizational transparency is the implementation of a new enterprise resource planning system that involves reengineering all of its business processes — the Agency-wide Information System for Programme Support (AIPS). In 2011, the Agency implemented Plateau 1 of AIPS, covering finance, procurement, asset management and programme management. Work continued during the year on Plateau 2, covering the management of contacts (that is, information relating to suppliers, customers and project counterparts, among others) and the planning and monitoring of programmes and projects.

The implementation of Plateau 1 of AIPS served

“A two stage budget preparation process using a new methodology was initiated that also considered the guidance given to the Secretariat by Member States and the priorities identified in the Medium Term Strategy 2012–2017.”

as the platform for the introduction, also in 2011, of IPSAS, the International Public Sector Accounting Standards. IPSAS is central to the reform of United Nations system management practices and the improvement of transparency and accountability.