

Overview

For over six decades, the Agency has pursued the goal of accelerating and enlarging the “contribution of atomic energy to peace, health and prosperity throughout the world” while ensuring that “assistance provided by it...is not used in such a way as to further any military purpose.” Under the motto ‘Atoms for Peace and Development’, it continues to make tangible contributions in meeting emerging global challenges in order to improve health, prosperity, peace and security around the world. By continuously adapting its diverse programmatic activities, within the framework of its Statute, the Agency has maintained the flexibility to address the evolving needs of Member States and to help them achieve their development goals.

This chapter provides an overview of some of the major global nuclear related developments in 2017 and how they were addressed through the Agency’s work. During 2017, programmatic activities focused, in a balanced manner, on developing and transferring nuclear technologies for peaceful applications, enhancing nuclear safety and security, and strengthening nuclear verification and non-proliferation efforts worldwide.

NUCLEAR TECHNOLOGY

Nuclear Power

Status and trends

A total of 448 nuclear power reactors were in operation at the end of 2017, including 4 reactors newly connected to the grid. Construction started on 4 reactors, with a total of 59 reactors under construction around the world; 5 reactors were permanently shut down. The global generating capacity of nuclear energy was 392 gigawatts (electrical) (GW(e)) at the end of 2017.

Compared with 2016 levels, the Agency’s 2017 projections for global installed nuclear power capacity showed an increase of 42% by 2030, an increase of 83% by 2040 and an increase of 123% by 2050 in the high case scenario. The low case scenario projected a 12% dip in capacity by 2030 and a 15% dip by 2040, before a return to current levels by 2050. During the year, 28 countries were considering or embarking on a nuclear power programme. Of the 30 countries already operating nuclear power plants, 13 were either constructing new reactors or actively completing previously suspended construction projects, and 16 had plans or proposals for building new reactors.

Major conferences

In June, the Agency organized the International Conference on Fast Reactors and Related Fuel Cycles: Next Generation Nuclear Systems for Sustainable Development (FR17)

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in Yekaterinburg, Russian Federation. More than 550 experts from 27 Member States and 6 international organizations exchanged information on national and international programmes, and on new developments and experience in the field of fast reactors and related fuel cycle technologies. The conference emphasized the importance of these technologies in sustainable nuclear power generation and featured events and contests for young nuclear scientists aimed at developing innovative solutions in this field.

The Agency's Fourth International Conference on Nuclear Power Plant Life Management, held in Lyon, France, in October, attracted more than 400 nuclear energy experts from over 38 countries and 4 international organizations. Conference participants discussed cost effective ways to safely operate nuclear power plants beyond their design lifetime and emphasized the need to maintain the current fleet of nuclear reactors until the next generation of reactors become operational.

Participants in the International Ministerial Conference on Nuclear Power in the 21st Century, organized by the Agency in cooperation with the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), concluded that nuclear power remains an important option for mitigating climate change and meeting the targets set out in the Paris Agreement and the Sustainable Development Goals (SDGs). Around 700 participants from 64 Member States and 6 organizations attended the conference, held in Abu Dhabi, United Arab Emirates, from 30 October to 1 November.

Climate change and sustainable development

At the 23rd session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP23), held in Bonn, Germany, in November, the Agency organized two side events highlighting the role of nuclear science and technology in combatting climate change and in contributing to sustainable development. It also worked with several organizations of the United Nations system to coordinate a third event, focused on Sustainable Development Goal 7 (affordable and clean energy).

At the 14th INPRO (International Project on Innovative Nuclear Reactors and Fuel Cycles) Dialogue Forum, held at the Agency's Headquarters in June, 35 participants from 23 Member States presented national and technical perspectives on the potential of nuclear energy to support the SDGs, including action to mitigate climate change.

Energy assessment services

During 2017, the Agency updated and enhanced its energy planning tools — now in use by 147 Member States — as well as the related multilingual training materials, including e-learning packages. It also conducted 45 capacity building events on energy planning through the technical cooperation programme, providing training to over 690 professionals from 70 Member States.

INPRO held two meetings to review national Nuclear Energy System Assessments (NESAs). The first was the final joint meeting of China, India and the Russian Federation on limited scope assessments of sodium cooled fast reactors using the INPRO methodology. The meeting, held in June in Vienna, enabled the three Member States to finalize their NESA country reports. At the second meeting, held in August in Vienna, INPRO carried out a final review of the strategic plan for the nuclear energy system in Ukraine. Ukraine will use the feedback to complete updates to its final NESA country report before submission to the Agency.

Support to operating nuclear power plants

The Agency conducted several events aimed at supporting human resources development programmes in Member States, including the Nuclear Operators Forum: Challenges in

Human Resources Management for Sustainable Nuclear Power Generation, attended by more than 100 experts in the field. Participants concluded that ensuring the availability of competent, qualified and capable staff, as a precondition for sustainable nuclear energy, requires a joint effort by governments, industry and academia to create functional training programmes both nationally and internationally.

Launching nuclear power programmes

The Agency continued its support of the 28 Member States considering or embarking on new nuclear power programmes. In January, it conducted an Integrated Nuclear Infrastructure Review (INIR) Phase 1 mission to Ghana. Since INIR's launch in 2009, a total of 22 INIR missions have been conducted to 16 Member States. To improve the quality and increase the consistency of these missions, the Agency published *Guidelines for Preparing and Conducting an Integrated Nuclear Infrastructure Review (INIR)* (IAEA Services Series No. 34). It also held meetings with nine embarking Member States to review or develop integrated work plans identifying and prioritizing areas for Agency support.

Capacity building, knowledge management and nuclear information

The Agency continued to support Member States in building their capacity to manage nuclear knowledge and information through training activities, schools and on-line courses. In 2017, it conducted five Knowledge Management Assist Visits to various nuclear organizations in Member States and held four Nuclear Energy Management (NEM) Schools, as well as one Nuclear Knowledge Management (NKM) School.

The number of courses hosted by the Agency's Cyber Learning Platform for Network Education and Training (CLP4NET) e-learning platform exceeded 580, and by the end of the year, there were around 21 300 registered CLP4NET users.

With Lesotho joining in 2017, the membership of the Agency's International Nuclear Information System (INIS) grew to 131 Member States and 24 international organizations. The IAEA Library continued to coordinate research support and document delivery among the 58 members of the International Nuclear Library Network.

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Assurance of supply

Significant progress was made on the IAEA Low Enriched Uranium (LEU) Bank project in Kazakhstan in 2017. Construction of the IAEA LEU Storage Facility was completed during the summer and the facility was inaugurated in August. The Agency issued a request for proposal for LEU acquisition in November. In 2017, two treaties for the IAEA LEU Bank entered into force: the IAEA LEU Bank Host State Agreement with the Republic of Kazakhstan and the Transit Agreement with the Russian Federation for the transit of LEU and equipment to and from the IAEA LEU Bank. The Transit Agreement with China was signed in 2017.

An LEU reserve in Angarsk, established following the Agreement of February 2011 between the Government of the Russian Federation and the Agency, remained operational.

Fuel cycle

The Agency organized some 30 meetings and workshops in 2017 aimed at increasing fuel cycle sustainability, including 3 Technical Meetings, 6 Research Coordination Meetings, a training workshop and 18 consultants meetings. These meetings focused on various aspects of uranium exploration, resources and production; environmental remediation of uranium mining sites; fuel development, design, manufacture and performance assessment; and spent fuel management.

Technology development and innovation

In October, the Agency conducted the first Technical Meeting on the Status and Evaluation of Severe Accident Simulation Codes for Water Cooled Reactors. Organized as a follow-up of the 2015 International Experts Meeting on Strengthening Research and Development Effectiveness in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant, the meeting was attended by 37 experts from 19 Member States and provided a forum for the exchange of information between code developers and end users.

In 2017, the Agency established a Technical Working Group on Small and Medium Sized or Modular Reactors to facilitate the development of this technology in Member States. In October, it organized a Technical Meeting on Technology Assessment of Small Modular Reactors for Near Term Deployment in Tunisia, Tunisia, aimed at enhancing the capacity of Member States in the Middle East and North Africa region to make knowledgeable technical decisions in adopting a nuclear reactor technology. In July, the Agency issued *Instrumentation and Control Systems for Advanced Small Modular Reactors* (IAEA Nuclear Energy Series No. NP-T-3.19), addressing issues and challenges related to the design, qualification and implementation of these systems for small and medium sized or modular reactors. In response to growing interest among Member States, the Agency launched a new coordinated research project (CRP) entitled 'Development of Approaches, Methodologies and Criteria for Determining the Technical Basis for Emergency Planning Zone for Small Modular Reactor Deployment'. The project's main objective is to develop methods for determining the appropriate size of emergency planning zones.

The Agency issued *Benchmark Analysis of EBR-II Shutdown Heat Removal Tests* (IAEA-TECDOC-1819), aimed at helping Member States to verify and validate their simulation tools for safety analysis of sodium cooled fast reactors.

In the area of non-electrical applications of nuclear power, the Agency published *Opportunities for Cogeneration with Nuclear Energy* (IAEA Nuclear Energy Series No. NP-T-4.1) and *Industrial Applications of Nuclear Energy* (IAEA Nuclear Energy Series No. NP-T-4.3). It also updated its Water Management Program (WAMP) tool, adding a new module to simulate nuclear power plants that use only reclaimed water for cooling, and conducted a training workshop on use of the tool for efficient water management in nuclear power plants.

Research reactors

The Agency released an e-learning course covering all aspects of neutron activation analysis. It continued to assist Member States, upon request, in minimizing the civilian use of high enriched uranium by supporting the conversion of research reactors and targets for radioisotope production to LEU fuel where such minimization is considered by these States to be technically and economically feasible. Activities in 2017 included the completion of a three year project to convert Ghana's miniature neutron source reactor to LEU fuel. The Belgian Nuclear Research Centre (SCK•CEN) and the United States Department of Energy's Idaho and Oak Ridge National Laboratories became IAEA-designated International Centres based on Research Reactors. The Agency also conducted pre-OMARR (Operation and Maintenance Assessment for Research Reactors) missions to Portugal and Uzbekistan.

Radioactive waste management, decommissioning and environmental remediation

The Agency issued two publications addressing the management of radioactive waste: *Selection of Technical Solutions for the Management of Radioactive Waste* (IAEA-TECDOC-1817) and *Use of the Benchmarking System for Operational Waste from WWER Reactors* (IAEA-TECDOC-1815). In the area of decommissioning and environmental remediation, the

Agency issued *Data Analysis and Collection for Costing of Research Reactor Decommissioning* (IAEA-TECDOC-1832) and the proceedings of an international conference entitled *Advancing the Implementation of Decommissioning and Environmental Remediation Programmes*.

The Agency supported preparations for the removal of 37 Category 1 and 2 disused sealed radioactive sources from Albania, Bolivia, Ecuador, Lebanon, Paraguay, Peru, the former Yugoslav Republic of Macedonia, Tunisia and Uruguay; the removals are scheduled for completion in 2018. The Agency also supported the training of some 200 experts from more than 20 Member States in conditioning, and safe and secure management of Category 3 to 5 disused sealed radioactive sources. Missions to condition disused sealed radioactive sources were conducted to Belize, China, the Dominican Republic, Ghana, the Islamic Republic of Iran, Jamaica and Malaysia.

Nuclear fusion

The Agency issued *Investigations of Materials under High Repetition and Intense Fusion Pulses* (IAEA-TECDOC-1829) in December. The publication presents experimental results and related simulations of plasma–surface interaction phenomena under the extreme conditions expected in a fusion reactor. In March, the Agency initiated a CRP entitled ‘Towards the Standardization of Small Specimen Test Techniques for Fusion Applications’. The project aims at producing guidelines for full standardization of small specimen testing based on common, agreed best practices for testing of reference structural materials for fusion reactors.

Nuclear data

The Agency played a significant role in the release of three major nuclear data libraries at the end of 2017: the ENDF/B-VIII (United States of America), JEFF-3.3 (OECD/NEA) and TENDL-2017 (Europe) nuclear data libraries for nuclear science and technology analyses. Through collaboration with nuclear physics experts, the Agency was able to deliver high quality isotopic evaluations of actinides and structural materials to these data libraries. It also performed integral validation with criticality benchmarks.

Accelerator applications

The Agency hosted the first Research Coordination Meeting of a CRP entitled ‘Accelerator Simulation and Theoretical Modelling of Radiation Effects – SMORE-II’. The project aims at establishing the efficacy of, and best practices for, accelerator based ion irradiation in testing of materials used for advanced reactor concepts and life extension of existing reactors.

Researchers from Member States carried out nine experiments at the Agency’s end station at the IAEA–Elettra Sincrotrone Trieste X ray fluorescence beamline. The experiments focused on environmental science, fundamental X ray physics, cultural heritage and industrial applications.

Nuclear instrumentation

Together with the Abdus Salam International Centre for Theoretical Physics (ICTP), the Agency organized a Joint ICTP–IAEA School on Zynq-7000 SoC and Its Applications for Nuclear and Related Instrumentation, held in Trieste, Italy. Nineteen young scientists from 15 countries learned about ‘system on chip’ (SoC) technology through lectures and hands-on activities. In March, the Agency began a new CRP entitled ‘Field-deployable Analytical Methods to Assess the Authenticity, Safety and Quality of Food’ to identify and select appropriate analytical techniques and to develop suitable assessment protocols.

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NUCLEAR SCIENCES AND APPLICATIONS

Major conferences

In April, the Agency held the first International Conference on Applications of Radiation Science and Technology (ICARST-2017) in Vienna, attracting more than 500 participants from 73 Member States. The conference provided a platform for scientists and industry professionals to discuss key developments in the application of radiation science and technology; global, regional and national initiatives for implementing proven industrial applications; and new initiatives to employ radiation technologies to meet emerging challenges.

The Agency hosted the Third FAO–IAEA International Conference on Area-wide Management of Insect Pests: Integrating the Sterile Insect and Related Nuclear and Other Techniques, in Vienna in May. The conference was attended by 360 delegates from 81 countries and 6 international organizations. There was general consensus on the need to target total pest populations rather than localized subsets, and on the need to integrate several synergistic, environment-smart technologies such as the sterile insect technique (SIT) in managing insect pests.

Participants in the second International Conference on Advances in Radiation Oncology (ICARO2), held in Vienna in June, sought to define the current role of technological, medical physics and radiobiological innovations and their potential incorporation into routine clinical practice in radiation oncology, one of the main pillars of cancer treatment. This year's conference drew 445 participants and observers from 95 Member States, with support provided by 19 professional organizations. Attendees discussed advances in technology, best practices and quality assurance methodologies, and took part in e-contouring training and automated planning demonstrations.

IAEA SCIENTIFIC FORUM

The IAEA Scientific Forum 2017, held during the 61st General Conference in September, examined the role that nuclear science plays in ensuring healthy lives and promoting well-being for all. Several high level speakers – including King Letsie III of Lesotho, the ministers of health of Cameroon and the Russian Federation, and over 40 dignitaries and experts – joined the Director General to present the role of nuclear techniques in the diagnosis, treatment and prevention of diseases, especially non-communicable diseases. In discussing the future of nuclear techniques in medicine, panellists highlighted the importance of partnerships between governments, non-governmental organizations, professional societies, international organizations and the private sector as a way to fund equipment purchases, expand access to nuclear medicine and radiotherapy procedures, and ensure a qualified workforce of health professionals.

Renovation of the Nuclear Applications Laboratories (ReNuAL)

The Renovation of the Nuclear Applications Laboratories (ReNuAL) project reached significant milestones in 2017. In September, the Agency inaugurated the new Insect Pest Control Laboratory, enabling it to provide Member States with expanded and enhanced SIT related services and training. Further extrabudgetary funds were raised during the year, bringing the overall financial contributions for modernization of the nuclear applications laboratories to nearly €32.5 million from 31 Member States and other contributors. Construction of the Flexible Modular Laboratory began in April. Efforts aimed at extending the Agency's partnerships and resource mobilization base beyond its

traditional partners resulted in a partnership concluded with Varian Medical Systems for a ten year loan of a linear accelerator to the Dosimetry Laboratory, complemented by an in-kind Member State contribution for servicing the equipment. The Agency also signed a memorandum of cooperation with Shimadzu Corporation for donation of a high speed liquid chromatograph–mass spectrometer, through the Peaceful Uses Initiative (PUI), for activities to support Member States in the area of food safety.

Food and Agriculture

Eradication of the Mediterranean fruit fly from the Dominican Republic

The Agency successfully concluded a two year technical cooperation project supporting efforts to eradicate the Mediterranean fruit fly from the Dominican Republic. At the Member State's request, the Agency, in partnership with the Food and Agriculture Organization of the United Nations (FAO) through the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, provided training and technical guidance in the area-wide application of SIT to control an outbreak of Mediterranean fruit fly, a major agricultural pest. The project, which also involved the United States Department of Agriculture, the International Regional Organization for Plant and Animal Health (OIRSA), the Inter-American Institute for Cooperation on Agriculture and the joint Guatemala–Mexico–USA Moscamed Programme, established surveillance systems throughout the country and provided training to local personnel in trapping and identifying the fly, and in using complementary pest control methods. In July, the Government officially declared the Dominican Republic to be free of Mediterranean fruit fly.

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Animal and zoonotic disease outbreaks: Diagnosis and control

The Veterinary Diagnostic Laboratory (VETLAB) Network continued to grow, with the addition of eight national laboratories in 2017. The network now extends to 44 countries in Africa and 19 countries in Asia. During the year, the Agency provided toolboxes for sample collection, packing and shipment from the field under biosecurity conditions, and diagnostic consumables for early detection of animal and zoonotic diseases. In particular, it provided toolboxes for sampling and detection of avian influenza or suspected Ebola carrier animals to Belize, Benin, Bulgaria, the Democratic Republic of the Congo, Croatia, the Lao People's Democratic Republic, Lesotho, Mozambique, Myanmar, Namibia, South Africa, Turkey, Uganda, Viet Nam and Zimbabwe. It also supported laboratory capacity building by providing training, equipment and expert advice to 35 Member States.

Climate-smart agriculture

Tracers are important components in the measurement of soil erosion, providing information useful for developing strategies to improve soil quality and soil conservation approaches. In 2017, the Agency, through the Joint FAO/IAEA Division, developed and began validating plutonium-239 and plutonium-240 radioisotopes as tracers for assessing soil erosion. With their much lower rates of decay (half-lives of more than 6500 years) than currently used radioisotopes (caesium-137, beryllium-7 and lead-210), plutonium-239+240 will facilitate long term assessment of soil erosion and degradation.

Regional food safety networks

The Agency continued to actively support the establishment and strengthening of food safety networks among laboratories and related institutions in 36 countries in Africa, 16 countries in the Asia and the Pacific region, and 21 countries in Latin America and

the Caribbean. In 2017, it initiated an interregional networking mechanism to support the transfer of analytical technologies and to facilitate the exchange of knowledge and expertise, to help Member States within the networks to address common challenges such as international food safety standards that impact trade.

Human Health

Nuclear techniques for the early diagnosis of Alzheimer's disease

Medical imaging, and in particular nuclear medicine, can improve the early and differential diagnosis of dementia, leading to better patient care. In 2017, the Agency raised awareness about the importance of nuclear techniques in the evaluation of patients with dementia – including Alzheimer's disease – and other neurological diseases through a side event during the 61st regular session of the General Conference in September. Presentations from the event were made available on the Agency's Human Health Campus web site. The Agency also provided training in the diagnosis of Alzheimer's disease to around 120 medical professionals through training courses held in Argentina, Brazil and Chile.

Addressing malnutrition using stable isotopes

The Agency, jointly with the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), organized a workshop entitled 'Analysis of Biological Pathways to Better Understand the Double Burden of Malnutrition and to Inform Action Planning' in Vienna in October. The workshop brought together some 50 researchers and public health professionals working in the fields of nutrition and diet related non-communicable diseases in 30 countries around the world. Participants shared information on the latest evidence regarding interlinkages of different forms of malnutrition, and identified research and policy gaps to tackle the double burden of malnutrition. The joint workshop was the focus of articles in *The Lancet Global Health* and *UN Special*.

Radiation risk assessment and risk perceptions in medical imaging

During the 61st regular session of the Agency's General Conference, the Agency organized a joint side event with WHO and the United Nations Scientific Committee on the Effects of Atomic Radiation to inform health professionals and other interested parties about radiation risk assessment and risk perception in medical imaging. More than 60 participants discussed the methodologies used for assessing doses and associated risks, perception magnitude and significance of dangers linked to medical exposures, and the importance of proper risk communication to patients.

Radioisotope Production and Radiation Technology

Regulatory aspects of radiopharmaceutical production

In October, the Agency held a Technical Meeting of regulators and researchers responsible for the safe preparation and use of radiopharmaceuticals from 15 Member States, WHO and several professional societies. The meeting provided a platform for evaluating the status of regulations governing radiopharmaceutical production in different countries and for exploring the possibility of harmonizing regulations with Agency support.

Industrial applications of radiotracers and sealed sources

The Agency's activities in the area of industrial applications of radiation technologies focused on capacity building initiatives in 2017. In June and July, the Agency held a training course on industrial applications of radiotracers and sealed sources at the IAEA Collaborating Centre at the National Institute for Nuclear Science and Technology in Saclay, France, with participants from Cameroon, Côte d'Ivoire, the Democratic Republic of the Congo, Gabon, Madagascar and Morocco. A training course on industrial application of radiotracers was held in November at the National Centre for Nuclear Energy, Sciences and Technology in Morocco, with participants from Egypt, Kenya, the Sudan and Zimbabwe. Both courses were organized through the Agency's technical cooperation programme and included an examination under the certification scheme of the International Society for Tracer and Radiation Applications.

Water Resources Management

Sustainable groundwater resources management in Africa

In May, the Agency published the main findings of the technical cooperation project entitled 'Integrated and Sustainable Management of Shared Aquifer Systems and Basins of the Sahel Region'. Project participants used tritium, a naturally occurring radionuclide, to map shallow, recently recharged groundwater and to identify the main sources of recharge. The project provided the first broad overview of the region's groundwater supplies. Among the main findings were that significant reserves of good quality water are available in the region and that pollution is still limited and not yet a threat to these water sources.

Environment

Strengthened analytical capacity for rapid response

For more than 20 years, the Agency has organized annual proficiency tests that allow hundreds of laboratories to monitor and improve their performance in analysing environmental radionuclides. In June, such a proficiency test was included in the Agency's Convention Exercises (ConvEx-3) emergency response exercise for the first time. Almost 90 laboratories worldwide participated, providing rapid analysis and reporting of radionuclide activity concentrations in specially prepared water samples. Overall results showed excellent agreement with reference values, demonstrating existing Member State capabilities for fast and reliable analyses in the case of environmental emergencies.

NUCLEAR SAFETY AND SECURITY

Nuclear Safety

Priorities for nuclear safety

The Agency identified priorities for continued work in strengthening nuclear, radiation, transport and waste safety, and emergency preparedness and response. These priorities include activities related to, inter alia, ageing management and long term operation of nuclear installations; leadership and management for safety; culture for safety; and activities related to radiation and waste safety improvements, such as decommissioning of nuclear installations, radiation protection and radioactive sources management.

Safety standards

In October, with the publication of *Safety of Nuclear Fuel Cycle Facilities* (IAEA Safety Standards Series No. SSR-4), the Agency completed the revision of its Safety Requirements to take into account lessons from the Fukushima Daiichi accident. Future revisions of safety standards and publications in the IAEA Nuclear Security Series will benefit from the Nuclear Safety and Security Online User Interface platform, launched during the Agency's General Conference in September. The new platform is in addition to the official communication channels and enables authorized users to provide direct feedback on current safety standards and IAEA Nuclear Security Series publications. The IAEA Safety Glossary has been integrated into the platform, enabling future electronic versions of the safety standards to include access to Glossary definitions.

Peer review and advisory services

“During the year, the Agency conducted over 50 safety related peer review and advisory service missions to more than 40 Member States”

Member State requests for peer review and advisory services continued to increase in 2017. During the year, the Agency conducted over 50 safety related peer review and advisory service missions to more than 40 Member States, including the first two Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) missions. The Agency carried out six Integrated Regulatory Review Service (IRRS) missions and seven follow-up IRRS missions; one Emergency Preparedness Review (EPREV) mission; seven Operational Safety Review Team (OSART) missions and seven follow-up OSART missions; three Safety Aspects of Long Term Operation (SALTO) missions and one follow-up SALTO mission; five Site and External Events Design (SEED) review missions; two Education and Training Appraisal (EduTA) missions; four Occupational Radiation Protection Appraisal Service (ORPAS) missions; one Independent Safety Culture Assessment (ISCA) mission; and three Integrated Safety Assessment of Research Reactors (INSARR) missions and two follow-up INSARR missions.

The Agency continued to strengthen its peer review and advisory services and self-assessment tools by incorporating lessons learned from their implementation. In August, 38 Member States provided feedback at a Technical Meeting to Assess the Overall Structure, Effectiveness and Efficiency of Peer Review and Advisory Services in the Areas of Nuclear Safety and Security, held in Vienna.

Safety of nuclear power plants, research reactors and fuel cycle facilities

The International Conference on Topical Issues in Nuclear Installation Safety: Safety Demonstration of Advanced Water Cooled Nuclear Power Plants, held in Vienna in June, drew more than 300 participants from 48 Member States. Attendees exchanged information on the latest approaches, advances and challenges in demonstrating the safety of nuclear power plants planned for the near future. During the conference, the Agency conducted a workshop on design extension conditions. Participants were provided with an overview of the Agency's design related Safety Requirements for nuclear power plants focused on design extension conditions.

In May, the Agency held the fourth International Meeting on Application of the Code of Conduct on the Safety of Research Reactors, with the participation of some 40 countries. During the year, it conducted three workshops in Vienna focusing on the safety of nuclear fuel cycle facilities. These workshops provided forums for over 72 participants from 29 Member States to share information, experience and good practices in establishing and supervising safety and protection programmes on the basis of the Agency's safety standards.

Incident and emergency preparedness and response

In response to increased Member State interest in harmonization of emergency preparedness and response arrangements, the Agency published *Guidelines on the Harmonization of Response and Assistance Capabilities for a Nuclear or Radiological Emergency* (EPR-Harmonized Assistance Capabilities 2017). It also held two workshops to assist Member States in Southeast Asia. In the first workshop, held in Singapore in June and attended by 21 participants from 10 Member States, a plan for a regional strategy for coordinating public communication in an emergency was defined. The second workshop, held in Pattaya, Thailand, from 28 August to 1 September and attended by 22 participants from 10 Member States, assisted Member States in developing adequate and harmonized emergency preparedness and response capabilities.

The Agency developed new guidelines for EPREV missions that improve the mission process, taking into account Member State experience and feedback, as well as recommendations from the Agency's Peer Review and Advisory Services Committee.

In June, the Agency conducted its largest ConvEx-3 exercise, hosted by Hungary, with the participation of 83 Member States and 11 international organizations. The 36 hour event, based on the scenario of a severe accident at the Paks nuclear power plant, allowed Member States and international organizations to evaluate their early response and the international emergency management system in a severe nuclear emergency. This year's ConvEx-3 exercise was the first to test the automatic interface between the emergency communication systems of the Agency and the European Commission.

Radioactive waste management, environmental assessments and decommissioning of nuclear facilities

The *Code of Conduct on the Safety and Security of Radioactive Sources: Guidance on the Management of Disused Radioactive Sources* (GC(61)/23) was approved by the Board of Governors and endorsed by the General Conference in September. The guidance takes into account the Agency's safety standards and nuclear security guidance, and addresses safety and security in an integrated manner.

In collaboration with Kyrgyzstan, Tajikistan, Uzbekistan, the European Bank for Reconstruction and Development, the European Commission and the State Atomic Energy Corporation "Rosatom", the Agency finalized the development of the *Strategic Master Plan for Environmental Remediation of Uranium Legacy Sites in Central Asia*, providing a strategy and implementation plan for remediating uranium legacy sites in Central Asia.

Radiation protection

In December, the Agency organized the International Conference on Radiation Protection in Medicine: Achieving Change in Practice, in Vienna. The conference's 534 participants from 96 Member States and 16 international organizations discussed, inter alia, the implementation of the Bonn Call for Action to improve radiation protection in medicine.

The Agency initiated a project to develop guidance on radioactivity in food and drinking water in non-emergency situations at a regional workshop held in March. With the cooperation of FAO, the Pan American Health Organization and WHO, workshop participants from 16 Member States identified a number of areas where greater consistency and harmonization regarding control of radioactivity would be beneficial. The project, implemented in cooperation with FAO and WHO, will address natural and artificial radionuclides in food and drinking water.

Leadership and management for safety, safety culture and communication on safety

An increasing number of Member States are requesting assistance in the area of leadership and management for safety. In collaboration with the European Commission, the Agency held the first Pilot International School of Nuclear and Radiological Leadership for Safety, in Nice, France, with the participation of 20 junior and middle managers from operators and regulators. The School is designed to increase the participants' ability to effectively address issues involving culture for safety. Case studies, presentations and keynote addresses, group exercises and discussions provided participants with a better understanding of what leadership for safety means in practice in working environments containing nuclear or radiological material.

In September, the Agency issued a Safety Guide entitled *Communication and Consultation with Interested Parties by the Regulatory Body* (IAEA Safety Standards Series No. GSG-6), providing recommendations on communication and consultation about the possible radiation risks associated with facilities and activities, and about processes and decisions of the regulatory body.

Capacity building in nuclear, radiation, transport and waste safety, and in emergency preparedness and response

In 2017, the Agency conducted 343 capacity building activities across its programme of work for nuclear, radiation, transport and waste safety, and emergency preparedness and response. In particular, through the analysis of mission findings it identified a need to further support Member States in strengthening their national human capacity building programmes.

In September, the National Institute of Radiological Sciences in Chiba, Japan, was designated as an IAEA Capacity Building Centre for emergency preparedness and response. The centre will provide national and international training courses, workshops and exercises related to the medical management of radiation exposures and dose assessment.

Strengthening global, regional and national networks and forums

The Agency coordinated over 100 national and regional activities under the auspices of the Global Nuclear Safety and Security Network (GNSSN). Within the GNSSN, the Secretariat developed a prototype Global Education and Training Resources platform, providing users with access to over 500 global training and educational resources and 25 e-learning modules.

In July, the Agency hosted the second coordination meeting of the Forum of Nuclear Regulatory Bodies in Africa, in Vienna. Meeting participants consolidated the position paper on the needs of the Forum, initiated in 2016, and prepared a survey for use in setting the priorities among the Forum's members.

In July, the Agency renewed its Practical Arrangements with the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO) on the 20th anniversary of its establishment, in Buenos Aires, Argentina.

Safety conventions

The Agency hosted the Seventh Review Meeting of the Contracting Parties to the Convention on Nuclear Safety in Vienna from 27 March to 7 April. The meeting, attended by more than 900 representatives of 77 Contracting Parties, approved several recommendations addressing, inter alia, evaluation of the effectiveness of the changes to the review process; topical sessions during future Review Meetings; organization of educational workshops

for countries without nuclear reactors to, inter alia, encourage participation and provide assistance in adhering to and meeting the obligations under the Convention; assessing the possibility of organizing video conferences for certain Country Group sessions; and streaming of parts of plenary sessions and the press conference on the Agency's web site. A workshop to promote adherence to the Convention was organized in Vienna in November for Member States from Asia and Latin America.

In May, the Agency hosted the Third Extraordinary Meeting of the Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, in Vienna. The Contracting Parties amended the *Guidelines regarding the Review Process* (INFCIRC/603/Rev.6) so that the Secretariat makes publicly available each National Report 90 days after the Review Meeting, unless the Contracting Party concerned notifies the Secretariat otherwise. The Organizational Meeting for the Sixth Review Meeting of the Contracting Parties to the Joint Convention was also held in Vienna in May. To mark the 20th anniversary of the Joint Convention, adopted on 5 September 1997, a side event was organized on the margins of the General Conference. A workshop to promote adherence to the Joint Convention was organized in December in Rabat, Morocco, for Member States in the African region.

Civil liability for nuclear damage

The International Expert Group on Nuclear Liability (INLEX) is an expert group that provides advice on issues related to nuclear liability as requested by the Director General or the Director of the Office of Legal Affairs. The 17th Meeting of INLEX took place in Vienna in May. The Group considered the possible exclusion of certain low risk installations from the scope of application of the liability conventions with specific reference to the case of installations being decommissioned and of installations for the disposal of certain types of low level radioactive waste. In this respect, the Group concluded that there is no need to exclude any such installations from the scope of application of the revised Vienna Convention on Civil Liability for Nuclear Damage and of the Convention on Supplementary Compensation for Nuclear Damage. The Group also discussed other liability issues relating to disposal facilities, to transportable nuclear power plants and to the transport of nuclear material, as well as the scope of application of the nuclear liability conventions as regards radioactive products or waste. However, the Group felt that these issues required a more detailed analysis and decided to consider them further at its next meeting.

The Sixth Workshop on Civil Liability for Nuclear Damage was held in Vienna in May. The workshop provided participants with an introduction to the international legal regime of civil liability for nuclear damage. Workshops on civil liability for nuclear damage were also held in Montevideo, Uruguay, in June, and in Accra, Ghana, in November, to provide participants with information on the existing international nuclear liability regime and to advise on the development of national implementing legislation. In addition, an Agency–INLEX follow-up mission to Malaysia was conducted in February to address issues relating to the implementation of the international nuclear liability regime.

In May, the Agency published *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage – Explanatory Texts* (IAEA International Law Series No. 3 (Revised)).

Nuclear Security

International Conference on Physical Protection of Nuclear Material and Nuclear Facilities

In November, the Agency, in cooperation with the World Institute for Nuclear Security, the World Nuclear Transport Institute and the International Criminal Police

Organization – INTERPOL, organized the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities. The conference drew some 700 experts from 95 States, representing competent authorities, facility operators, shippers and carriers, and technical support organizations. Participants shared lessons learned and good practices in implementing the *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)* (IAEA Nuclear Security Series No. 13).

Nuclear Security Plan 2018–2021

At its September meeting, the Board of Governors approved the *Nuclear Security Plan 2018–2021*. The Plan provides details of proposed Agency nuclear security activities for the period 2018–2021. It corresponds to the priorities of Member States expressed through the decisions and resolutions of the Agency’s Policy-Making Organs as well as priority setting for IAEA Nuclear Security Series guidance as recommended by the Nuclear Security Guidance Committee.

Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM)

The Agency continued to promote universal adherence to the Amendment to the Convention on the Physical Protection of Nuclear Material through Technical Meetings, expert missions and promotional efforts. In November, it organized the third Technical Meeting of the Representatives of States Parties to the Convention on the Physical Protection of Nuclear Material (CPPNM) and the CPPNM Amendment, in Vienna, with the participation of 50 Parties to the CPPNM. The representatives discussed, inter alia, the Amendment, with particular emphasis on preparations for a conference of States Parties to the Amendment in 2021. In addition, the Agency conducted an expert mission to Uganda in May, to encourage adherence to the Amendment.

Capacity building

“In 2017, the Agency conducted 111 security related training activities... providing training to more than 2000 participants from 158 States.”

In 2017, the Agency conducted 111 security related training activities – 57 at the national level and 54 at the international or regional level – providing training to more than 2000 participants from 158 States. It launched new e-learning modules on: Nuclear Security Threats and Risks, including a new Overview, and separate modules on Material and Facilities, Material out of Regulatory Control and Cyber Threats; Use and Maintenance of Portable HPGe Gamma-Ray Spectrometer; and Preventive and Protective Measures Against Insider Threats. The courses provide an introduction to the basic principles of nuclear security based on the Agency’s nuclear security recommendations and guidance.

IPPAS missions

The Agency conducted six International Physical Protection Advisory Service (IPPAS) missions, including two follow-up IPPAS missions. In October, it hosted the third International Workshop on the International Physical Protection Advisory Service (IPPAS) for Potential Team Members of Future IPPAS Missions, in Vienna. The workshop, attended by 53 participants from 29 Member States, was aimed at increasing the number of experts able to participate in such missions.

NUCLEAR VERIFICATION^{1,2}

Implementation of safeguards in 2017

At the end of every year, the Agency draws a safeguards conclusion for each State for which safeguards are applied. This conclusion is based on an evaluation of all safeguards relevant information available to the Agency in exercising its rights and fulfilling its safeguards obligations for that year.

In 2017, safeguards were applied for 181 States^{3,4} with safeguards agreements in force with the Agency. Of the 127 States that had both a comprehensive safeguards agreement (CSA) and an additional protocol (AP) in force⁵ the Agency drew the broader conclusion that *all* nuclear material remained in peaceful activities for 70 States⁶; for the remaining 57 States, as the necessary evaluation regarding the absence of undeclared nuclear material and activities for each of these States remained ongoing, the Agency concluded only that *declared* nuclear material remained in peaceful activities. For 46 States with a CSA but with no AP in force, the Agency concluded only that *declared* nuclear material remained in peaceful activities. For those States for which the broader conclusion has been drawn, the Agency is able to implement integrated safeguards: an optimized combination of measures available under CSAs and APs to maximize effectiveness and efficiency in fulfilling the Agency's safeguards obligations. During 2017, integrated safeguards were implemented for 65 States^{7,8}.

Safeguards were also implemented with regard to nuclear material in selected facilities in the five nuclear-weapon States party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) under their respective voluntary offer agreements. For these five States, the Agency concluded that nuclear material in selected facilities to which safeguards had been applied remained in peaceful activities or had been withdrawn from safeguards as provided for in the agreements.

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

¹ The designations employed and the presentation of material in this section, including the numbers cited, do not imply the expression of any opinion whatsoever on the part of the Agency or its Member States concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

² The referenced number of States Parties to the Treaty on the Non-Proliferation of Nuclear Weapons is based on the number of instruments of ratification, accession or succession that have been deposited.

³ These States do not include the Democratic People's Republic of Korea (DPRK), where the Agency did not implement safeguards and, therefore, could not draw any conclusion.

⁴ And Taiwan, China.

⁵ Or an additional protocol being provisionally applied, pending its entry into force.

⁶ And Taiwan, China.

⁷ Albania, Andorra, Armenia, Australia, Austria, Bangladesh, Belgium, Botswana, Bulgaria, Burkina Faso, Canada, Chile, Croatia, Cuba, Czech Republic, Denmark, Ecuador, Estonia, Finland, Germany, Ghana, Greece, Holy See, Hungary, Iceland, Indonesia, Ireland, Italy, Jamaica, Japan, Kazakhstan, Republic of Korea, Latvia, Libya, Lithuania, Luxembourg, Madagascar, Mali, Malta, Mauritius, Monaco, Montenegro, Netherlands, New Zealand, Norway, Palau, Peru, Philippines, Poland, Portugal, Romania, Seychelles, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Tajikistan, the former Yugoslav Republic of Macedonia, Ukraine, United Republic of Tanzania, Uruguay, Uzbekistan and Viet Nam.

⁸ And Taiwan, China.

As of 31 December 2017, 12 States Parties to the NPT had yet to bring CSAs into force pursuant to Article III of the Treaty. For these States Parties, the Agency could not draw any safeguards conclusions.

Conclusion of safeguards agreements and APs, and amendment and rescission of small quantities protocols

The Agency continued to implement the *Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols*⁹, which was updated in September 2017. During 2017, a CSA with a small quantities protocol (SQP) and an AP were signed for one State¹⁰. In addition, three States¹¹ brought an AP into force. One State¹² acceded to the safeguards agreement between the non-nuclear-weapon States of Euratom, Euratom and the Agency, and to the protocol additional thereto. An INFCIRC/66/Rev.2-type agreement was signed and entered into force for one State¹³. By the end of 2017, safeguards agreements were in force with 182 States and APs were in force with 132 States. An AP continued to be provisionally applied pending its entry into force for one State¹⁴. Moreover, an SQP became non-operative for one State.¹⁵ By the end of 2017, 62 States had accepted the revised SQP text (which was in force for 55 of these States) and 7 States had rescinded their SQPs.

Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015)

Throughout 2017, the Agency continued to verify and monitor the nuclear-related commitments of the Islamic Republic of Iran (Iran) under the Joint Comprehensive Plan of Action (JCPOA). During the year, the Director General submitted four reports to the Board of Governors and in parallel to the United Nations Security Council entitled *Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015)* (GOV/2017/10, GOV/2017/24, GOV/2017/35 and GOV/2017/48).

Syrian Arab Republic (Syria)

In August 2017, the Director General submitted a report to the Board of Governors entitled *Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic* (GOV/2017/37) covering relevant developments since the previous report in August 2016 (GOV/2016/44). The Director General informed the Board of Governors that no new information had come to the knowledge of the Agency that would have an impact on the Agency's assessment that it was very likely that a building destroyed at the Dair Alzour site was a nuclear reactor that should have been declared to the Agency by Syria.¹⁶ In 2017, the Director General renewed his call on Syria to cooperate fully with the Agency in connection with

⁹ Available at: <https://www.iaea.org/sites/default/files/sg-plan-of-action-2016-2017.pdf>.

¹⁰ Liberia.

¹¹ Honduras, Senegal and Thailand.

¹² Croatia.

¹³ Pakistan.

¹⁴ Islamic Republic of Iran.

¹⁵ United Arab Emirates.

¹⁶ The Board of Governors, in its resolution GOV/2011/41 of June 2011 (adopted by a vote), had, inter alia, called on Syria to urgently remedy its non-compliance with its NPT Safeguards Agreement and, in particular, to provide the Agency with updated reporting under its Safeguards Agreement and access to all information, sites, material and persons necessary for the Agency to verify such reporting and resolve all outstanding questions so that the Agency could provide the necessary assurance as to the exclusively peaceful nature of Syria's nuclear programme.

unresolved issues related to the Dair Alzour site and other locations. Syria has yet to respond to these calls.

On the basis of the evaluation of information provided by Syria and all other safeguards relevant information available to it, the Agency found no indication of the diversion of declared nuclear material from peaceful activities. For 2017, the Agency concluded for Syria that declared nuclear material remained in peaceful activities.

Democratic People's Republic of Korea (DPRK)

In August 2017, the Director General submitted a report to the Board of Governors and General Conference entitled *Application of Safeguards in the Democratic People's Republic of Korea* (GOV/2017/36–GC(61)/21), which provided an update of developments since the Director General's report of August 2016 (GOV/2016/45–GC(60)/16).

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, the Agency could not draw any safeguards conclusion regarding the DPRK.

On 3 September 2017, the DPRK announced that it had conducted a nuclear test.

In 2017, no verification activities were implemented in the field but the Agency continued to monitor the DPRK's nuclear activities by using open source information, including satellite imagery and trade information. In June 2017, the Director General indicated his intention to enhance the Agency's readiness to play an essential role in verifying the DPRK's nuclear programme. To this end, in August 2017, a DPRK Team was formed within the Department of Safeguards to enhance the monitoring of the DPRK's nuclear programme; maintain updated verification approaches and procedures for the nuclear facilities known to exist within the DPRK; prepare for the Agency's return to the DPRK; and ensure the availability of appropriate verification technologies and equipment. An Executive Group was also formed within the Secretariat to consider procedural, managerial and legal matters.

During 2017, the Agency continued to observe indications that were consistent with the operation of the Yongbyon Experimental Nuclear Power Plant (5 MW(e)) which commenced the current operational cycle in early December 2015. The Agency did not observe indications of reprocessing operations at the Radiochemical Laboratory during 2017. At the Yongbyon Nuclear Fuel Rod Fabrication Plant there were indications consistent with the use of the reported centrifuge enrichment facility located within the plant. Construction work was undertaken on a building that adjoins the reported centrifuge enrichment facility. There were indications in the light water reactor construction yard of an increase in activities consistent with the fabrication of certain reactor components. The Agency has not observed indications of the delivery or introduction of major reactor components into the reactor containment building.

The Agency has not had access to the Yongbyon site. Without access to the site, the Agency cannot confirm the operational status of the facilities on the site, or the nature and purpose of the activities observed.

The continuation and further development of the DPRK's nuclear programme are a cause for grave concern. The DPRK's nuclear activities are deeply regrettable and clear violations of relevant United Nations Security Council resolutions, including resolutions 2371 (2017), 2375 (2017) and 2397 (2017). The DPRK's sixth nuclear test, announced on 3 September 2017, was also in clear violation of United Nations Security Council resolutions and is extremely regrettable.

Enhancing safeguards

During 2017, the Agency developed new State-level safeguards approaches as described in the Director General's reports GOV/2013/38 and GOV/2014/41 and Corr.1. This resulted in new State-level safeguards approaches for 62 States, bringing the total number of States for which State-level safeguards approaches have been developed to 126. In developing and implementing a State-level safeguards approach, consultations were held with the relevant State and/or regional authority, particularly on the implementation of in-field safeguards measures.

Cooperation with State and regional authorities

To assist States in building capacity for implementing their safeguards obligations, the Agency conducted seven international, regional and national training courses for those responsible for overseeing and implementing the State and regional systems of accounting for and control of nuclear material. More than 180 participants from some 40 countries attended the courses. The Agency also participated in nine other training activities organized by Member States on a bilateral basis. In 2017, the Agency carried out an Integrated Nuclear Infrastructure Review (INIR) mission to Ghana that included, inter alia, advice on how to systematically enhance the capabilities necessary for the application of safeguards while embarking on a nuclear power programme.

Safeguards equipment and tools

Throughout 2017, the Agency ensured that the instrumentation and monitoring equipment installed in nuclear facilities around the world, which is vital to effective safeguards implementation, continued to function as required. It continued with the next generation surveillance system implementation campaign, replacing outdated surveillance units. At the end of 2017, a total of 750 next generation surveillance system cameras had been installed.

Safeguards analytical services

In 2017, the Agency collected 599 nuclear material samples, which were analysed by the Agency's Nuclear Material Laboratory. It also collected 483 environmental samples during the year, which were analysed by the Network of Analytical Laboratories, including at the Agency's Environmental Sample Laboratory and the Nuclear Material Laboratory.

Developing the safeguards workforce

In 2017, the Agency conducted 173 safeguards training courses to provide safeguards inspectors and analysts with the necessary technical and behavioural competencies. These included two sessions of the Introductory Course on Agency Safeguards held at Agency Headquarters for 24 newly recruited inspectors, and several courses held at nuclear facilities to enhance practical competencies for safeguards implementation in the field.

Information technology: MOSAIC

By the end of 2017, the Modernization of Safeguards Information Technology (MOSAIC) project had delivered 17 newly developed or refurbished software applications or systems, while continuing to strengthen measures for the secure protection of safeguards data. Overall, MOSAIC continued to make steady progress towards its planned completion by May 2018.

“In 2017, the Agency conducted 173 safeguards training courses to provide safeguards inspectors and analysts with the necessary technical and behavioural competencies.”

Preparing for the future

Under the departmental strategic planning framework, the Agency held a workshop on emerging technologies in February, which fostered the update of the *Research and Development Plan (R&D)* and the biennial *Development and Implementation Support Programme for Nuclear Verification 2018–2019*. These two documents inform Member States about required support to improve the Agency's technical capabilities. The Development and Implementation Support Programme for Nuclear Verification comprises 314 support programme tasks in 24 projects. At the end of 2017, 20 States¹⁷ and the European Commission had formal support programmes with the Agency.

MANAGEMENT OF TECHNICAL COOPERATION FOR DEVELOPMENT

The technical cooperation programme in 2017

The technical cooperation programme is the Agency's key mechanism for transferring technology and building capacities in the peaceful use of nuclear science and technology. In 2017, safety and security accounted for the highest proportion of actuals (disbursements) delivered through the technical cooperation programme, at 25.0%. This was followed by health and nutrition at 24.3%, and by food and agriculture at 19.4%. By the end of the year, financial implementation of the Technical Cooperation Fund (TCF) stood at 86.3%. Regarding non-financial implementation, the programme supported, inter alia, 3641 expert and lecture assignments, 222 regional and interregional training courses, and 1979 fellowships and scientific visits.

First international conference on the technical cooperation programme

As part of the activities to mark its 60th anniversary, the Agency hosted the first International Conference on the IAEA Technical Cooperation Programme: Sixty Years and Beyond – Contributing to Development, highlighting the programme's role in helping Member States achieve their development priorities. Held in Vienna from 30 May to 1 June, the conference brought together over 1200 participants from 160 countries and 27 organizations, and was attended by three Heads of State or Government and 16 Ministers. Participants shared success stories demonstrating how the technical cooperation programme has transferred technology, supported capacity building and facilitated international cooperation. Attendees explored new, and strengthened existing, partnerships and discussed the contribution that the programme can make to Member State efforts to achieve their SDGs.

Technical cooperation and the global development context

Member States are increasingly emphasizing the links between the technical cooperation programme and global and national commitments on climate change and the SDGs. The Agency highlighted the importance of nuclear science and technology and its contribution to achieving the SDGs at the United Nations High-level Political Forum on Sustainable Development through a side event entitled 'Science with Impact: Sustainable Development through Nuclear Technology'. The event was co-hosted by the Permanent Missions of Botswana and of Malaysia to the United Nations.

¹⁷ Argentina, Australia, Belgium, Brazil, Canada, China, Czech Republic, Finland, France, Germany, Hungary, Japan, Republic of Korea, Netherlands, Russian Federation, South Africa, Spain, Sweden, United Kingdom and United States of America.

Twenty Country Programme Frameworks and 12 United Nations Development Assistance Frameworks were co-signed in 2017.

Overview of regional activities

Africa

In Africa, activities to support Member States focused on human resource capacity building, networking, partnership facilitation and procurement of equipment. Priority was given to interventions in the fields of human health, agriculture and food security, water resource management, and legal and regulatory frameworks for radiation safety.

In the area of cancer treatment, several countries, including Botswana, Côte d'Ivoire, Ethiopia, Madagascar, Mali, Mozambique, Niger, Senegal, Uganda, the United Republic of Tanzania and Zimbabwe, reached the final stage of establishing, re-establishing, strengthening or expanding their radiotherapy services in 2017, with Agency support. In Côte d'Ivoire, the Agency provided training for six radiation oncologists and medical physicists serving in the country's first national radiotherapy centre, inaugurated in December.

The Agency is helping Member States to improve several mutant lines in various crops, including rice lines with drought and blast disease resistance in Egypt, and cowpea and sorghum with better yields in drought conditions in Namibia. In 2017, Zimbabwe officially released a more drought resistant variety of cowpea. Soil and water management practices were improved, using isotopic techniques, to enhance crop productivity in the Sudan and to reduce soil erosion in Morocco. In Benin and Mauritania, livestock productivity was improved through cross-breeding programmes and artificial insemination using nuclear derived techniques, contributing to improved food security. Senegal continued its long term efforts to eradicate the tsetse fly in the Niayes area through the application of SIT, with support from the Agency. Positive socioeconomic impact is visible in Niayes, where, free of the threat of tsetse, it has become possible to improve cattle breeds and to substantially increase milk and meat production.

The Agency sponsored a meeting of representatives of 39 African Member States, who developed a strategy to strengthen national and regional capacities to detect, and take appropriate early measures against, emerging zoonotic diseases such as the Ebola virus, Marburg fever, monkeypox and highly pathogenic avian flu. The strategy enhances cooperation among national actors from the public health, veterinary and wildlife services.

In 2017, emphasis was placed on building the capacities of waste regulators and operators for the safe management of radioactive waste. At training and demonstration exercises conducted in Egypt and Morocco, the Agency provided basic training in waste conditioning operations and in the storage of low activity gamma sources and neutron sources to more than 120 representatives of waste operators from 30 African Member States. It also provided support to Ghana to advance the country's planned disposal of disused sealed radioactive sources. An upgraded mobile hot cell that, after adequate conditioning and packaging, allows for their direct disposal into borehole facilities was developed as part of a technical cooperation project; the new capabilities were demonstrated by the South African Nuclear Energy Corporation.

Asia and the Pacific

In the Asia and the Pacific region, the key areas of focus in 2017 were safety and security, food and agriculture, and human health and nutrition.

The Agency provided internationally recognized and accredited training programmes through the IAEA Curricula for Nuclear Medicine Professionals. Two regional workshops were conducted in 2017, attended by 65 trainees from 18 Member States, and related

training materials were developed. The training programmes, developed by the Agency and collaborators from regional academic institutions, provide a framework for the systematic, sustainable and harmonized development of human health professional competencies. The workshops enhanced regional capacities in applying hybrid imaging in: oncology; neuroimaging; nuclear cardiology; diagnosis of infection/inflammation; paediatric and therapeutic nuclear medicine; and applications of theranostics (which ‘personalizes’ medicine by combining diagnosis and therapeutics). In Cambodia, the Agency continued to support the establishment of the National Cancer Centre through the provision of long term training, equipment and expert advice. The Centre is designed to cover up to 60% of the national demand for cancer diagnosis and treatment.

The Agency supported efforts by the Philippines to fully automate its gamma irradiation facility, providing technical assistance in the review of the design and specifications for the fully automated system. The new system will significantly enhance the safety and throughput of the facility, enabling it to meet growing industry demands for services such as food preservation, sterilization of medical equipment and industrial processing. The International Centre for Synchrotron Light for Experimental Science and Applications in the Middle East, a major international centre for scientific research in the Middle East that has benefited from significant Agency support, was inaugurated in May. The centre will enable scientists from the region to cooperate on advanced technology research projects.

Bangladesh made significant progress in crop improvement using mutation breeding in 2017. With the Agency’s assistance, it produced new crop varieties with increased yield and salt and submergence tolerance, and over 6000 tonnes of rice seeds were distributed to farmers across the country. In the Lao People’s Democratic Republic, the Agency helped the National Animal Health Laboratory to improve disease diagnosis and control activities for various transboundary animal diseases.

Radiation safety infrastructure in the Asia and the Pacific region was upgraded in 2017 through national and regional projects. Technical cooperation activities included support for participation in a postgraduate educational training course and a ‘train the trainers’ course for radiation safety officers. In addition, 19 participants from 10 countries took part in the School for Drafting Regulations on Radiation Safety. The Agency provided various tools to support Member State efforts to manage their regulatory activities, protect personnel occupationally exposed to radiation and conduct dose assessments for medical purposes. For example, Kuwait, Mongolia, Palau and Sri Lanka received the Regulatory Authority Information System (RAIS) software, a tool to assist Member States in managing their regulatory control programmes in accordance with Agency safety standards. The Agency also launched a regional effort involving 12 Member States aimed at enhancing emergency preparedness and response at the local, regional and international levels, focusing specifically on using radiation technologies to support the mitigation and recovery of civil structures affected by natural disasters.

The Agency continued to support efforts to introduce nuclear science and technology to students in secondary schools in the region. In an assessment in 2017, it was reported that over 1300 teachers were trained in pilot countries, and in total, the project reached more than 24 700 secondary school students.

Europe and Central Asia

The 32 Member States in the Europe and Central Asia region that participate in the technical cooperation programme display significant differences in their level of socioeconomic development and their application of nuclear technologies. The development of institutional and human resource capacities and the enhancement of cooperation among Member States are important features of the technical cooperation programme’s activities in the region. In 2017, these activities focused on four thematic areas that were identified as priorities in the updated Regional Profile and in many Country Programme

“The training programmes...provide a framework for the systematic, sustainable and harmonized development of human health professional competencies.”

Frameworks: nuclear and radiation safety, nuclear energy, human health, and isotope and radiation technology applications.

Demand for technical cooperation services related to nuclear power continued to increase in the region, where the development of nuclear power programmes is under way or under consideration in several countries. Two regional projects, entitled ‘Strengthening Nuclear Power Plant Lifetime Management for Long Term Operation’ and ‘Enhancing Energy Planning, Nuclear Power Infrastructure Development and Nuclear Safety Regulatory Oversight’, continued to support the development of nuclear power infrastructure. The Agency provided three Member States with assistance in strategy development, feasibility, financing and nuclear power infrastructure programme management related to the 19 issues identified in the Agency’s Milestones approach. For example, Kazakhstan, which is considering the construction of a nuclear power plant (Phase I of the Milestones approach), was visited by Agency experts to assist it in making an informed decision on the future of nuclear power in the country.

The Agency organized a group fellowship training event at the Institute for Nuclear Technology, in Zagreb, Croatia, to build capacity by familiarizing participants with advanced non-destructive examination/in-service inspection technology and maintenance optimization techniques. The event was attended by nine fellows from the five countries in the Europe region having nuclear power plants. Participants gained practical experience valuable for the preparation of licence submissions for plant life management.

Agency support for nuclear medicine and cancer treatment services continued to be in high demand. The Agency provided training and workshops in English and Russian as part of a regional project to improve and harmonize quality assurance and quality control in medical applications of X rays. During the year, 117 project participants from 14 countries developed a simple descriptive handbook for harmonized quality control protocols for diagnostic radiology, which can be used as a reference for performance testing of major modalities in diagnostic radiology departments. In Estonia, the Agency provided training to enable medical practitioners to upgrade their knowledge and skills, and supported improvements to the country’s operational infrastructure allowing new diagnostic and therapeutic methods to be made available for cancer patients.

Latin America and the Caribbean

In the Latin American and the Caribbean region, technical cooperation assistance provided in 2017 was directed mainly to the areas of human health and nutrition, followed by safety, food and agriculture, and water and the environment.

In health, activities focused on building capacity in radiation medicine; launching a one year master’s programme on advanced radiotherapy; and supporting the training of professionals working with paediatric patients in diagnostic imaging modalities and radionuclide therapies. Several Member States prioritized the establishment of brachytherapy programmes for gynaecological tumours. With the Agency supporting equipment provision and training, the first public brachytherapy service in Honduras was inaugurated at San Felipe General Hospital.

In the area of safety, the regional programme focused on strengthening regulatory infrastructure, improving safety for end users, and reinforcing emergency preparedness and response capabilities. A new approach to delivering safety assistance through national and regional programmes was incorporated into the design of projects for the coming technical cooperation cycle. New Agency Member States in the Caribbean received expert support throughout 2017 to establish regulatory infrastructure and to strengthen control of radioactive sources.

Other regional projects in 2017 helped strengthen Member States’ capacity to manage natural resources such as water, and to identify appropriate energy mixes to meet future energy demand. Initial steps towards the establishment of a Caribbean Observing Network

for Ocean Acidification, which will monitor ocean acidification and its impact on harmful algal blooms, were taken with the identification of Colombia, Costa Rica, Cuba and Mexico to serve as reference centres for monitoring.

The Agency successfully concluded its emergency assistance to the Dominican Republic in support of eradicating the Mediterranean fruit fly, a major agricultural pest. National capabilities were developed for the area-wide application of SIT, which contributed to the resumption of exports of fruit and vegetables that had been banned following the fly outbreak.

Programme of Action for Cancer Therapy (PACT)

The Agency continued to address the need of Member States to establish or enhance radiotherapy programmes. Activities in 2017 focused on reviewing national capacities for cancer control, addressing funding gaps in cancer related technical cooperation projects and mobilizing additional resources for sustainable cancer services. In collaboration with key partners and donors, the Agency helped low and middle income Member States to enhance the effectiveness of radiation medicine services as part of a comprehensive cancer control framework, and supported the training of health professionals and fundraising to boost cancer control activities. The Agency established a new partnership with the International Federation of Pharmaceutical Manufacturers and Associations.

The Agency, in cooperation with the Organisation of Islamic Cooperation and the Islamic Development Bank, prepared and conducted the IAEA–OIC–IsDB meeting in the Sudan with the participation of 16 Member States, development banks and WHO to review funding gaps for cancer control priorities, and supported Member States in the development of funding proposals and bankable documents to expand cancer related diagnostic and treatment capacities. In 2017, the Korea Institute of Radiological and Medical Sciences provided training in advanced radiotherapy techniques to its 35th fellow since 2013.

The Agency, jointly with WHO, conducted imPACT ('integrated missions of PACT') Review missions to four Member States – Burundi, the Democratic Republic of the Congo, Swaziland and Togo. The imPACT missions assessed national cancer control needs and capacities and provided recommendations for addressing the national cancer burden. Costa Rica, Lesotho, Mozambique, Nicaragua and Rwanda received expert advisory support for the development of national cancer control plans. Fiji received expert assistance to develop a roadmap to implement its national cancer control plan, and to conduct a detailed costing exercise for the establishment of a radiotherapy facility.

A meeting of 29 international cancer experts was held in Vienna in January to identify challenges and propose solutions to improve access to affordable, quality, sustainable radiotherapy technology and services in low and middle income Member States. The Agency continued to participate in key global health events such as the World Health Summit held in October in Berlin, which brought together 2000 representatives from academia, government, the private sector and civil society from 100 countries. The Agency stressed its role in fostering innovation and expanding access to quality health care, highlighting the importance of the integration of radiation medicine in sustainable comprehensive national cancer control strategies. Potential funding and partnership opportunities were additionally explored.

Legislative assistance

In 2017, the Agency continued to provide legislative assistance to its Member States through the technical cooperation programme. Country specific bilateral legislative assistance was provided to 20 Member States through written comments and advice on drafting national nuclear legislation, and four regional and five national workshops or training courses on nuclear law were organized during the year.

“the Agency helped low and middle income Member States to enhance the effectiveness of radiation medicine services as part of a comprehensive cancer control framework, and supported the training of health professionals and fundraising to boost cancer control activities.”

The Agency also organized the seventh session of the Nuclear Law Institute in Baden, Austria, in October. Sixty participants from Member States attended the training. The Nuclear Law Institute is designed to meet increasing Member State demand for legislative assistance and to enable participants to acquire a solid understanding of all aspects of nuclear law, with a particular focus on legislative drafting.

Technical cooperation programme management

The Agency provided support to Member States and staff in 2017 through a series of training events, workshops and briefing sessions covering every phase of the technical cooperation programme cycle. The goal was to increase the efficiency, effectiveness and results orientation of programmes and projects throughout the planning, implementation and review stages.

Quality assurance activities related to the design of the 2018–2019 programme cycle were implemented through a two step mechanism. The Agency first provided project teams with feedback and guidance on the requirements for high quality project design; it then conducted a final quality review of all projects submitted by Member States. All quality reviews assessed two aspects of project design: the extent to which the project addressed an area of real need in which there was a national programme enjoying strong government commitment and support; and the extent to which the project design complied with the logical framework approach. This comprehensive approach was aimed at ensuring the quality of individual project designs and enabling comparison with previous technical cooperation cycles, and identifying lessons learned and areas for improvement in future cycles.

The Agency's new platform for electronic submission of Project Progress Assessment Reports became fully operational in 2017. The new system enables quicker and more relevant reporting by Member States and feedback from the Secretariat.

Financial resources

The technical cooperation programme is funded by contributions to the TCF, as well as through extrabudgetary contributions, government cost sharing and contributions in kind. Overall, new resources reached a total of some €105.6 million in 2017, with approximately €83.3 million for the TCF (including assessed programme costs, National Participation Costs and miscellaneous income), €21.7 million in extrabudgetary resources, and about €0.6 million representing in kind contributions.

The rate of attainment for the TCF stood at 99.6% on pledges and at 97.7% on payments at the end of 2017, while payment of National Participation Costs totalled €0.6 million.

Actuals

In 2017, approximately €85 million was disbursed to 144 countries or territories, of which 35 were least developed countries, reflecting the Agency's ongoing effort to address the development needs of those States.

MANAGEMENT ISSUES

Gender equality and gender mainstreaming

The proportion of women in the professional and higher categories was 29% and that of women in senior management positions (D level or higher) had reached 28.3% as of the end of 2017. In June, the Director General and Deputy Director General and

“The proportion of women in the professional and higher categories was 29% and that of women in senior management positions...had reached 28.3% as of the end of 2017.”

Head of the Department of Management became International Gender Champions and made commitments to advance the Agency's work on gender equality. In September, the Secretariat conducted the first Agency-wide survey on gender equality; the data provided are being used to determine levels of awareness, knowledge and skills in relation to gender equality and to develop focused awareness raising and training activities.

Multilingual web site

In June, as the first phase of the multilingual web site project, the Agency launched web sites in Arabic, Chinese, French, Russian and Spanish. The second phase of the multilingual web site project was initiated in October in order to expand the information available in languages other than English.

Agency-wide Information System for Programme Support (AIPS)

The final component of the Agency-wide Information System for Programme Support (AIPS) — a new portal for Member States — went live in May 2017, and the AIPS project was officially closed at the end of June, on time and on budget.

Information and IT security

The Agency continued an initiative, begun in 2016, aimed at strengthening its information and IT security. Projects undertaken in 2017 focused on development of more comprehensive information security rules and procedures, preparation of an information security awareness programme to be rolled out in 2018, and implementation of additional security controls on the Agency's IT infrastructure.

Partnerships and resource mobilization

The Secretariat continued to implement the Strategic Guidelines on Partnerships and Resource Mobilization with a one-house approach. As reported to the Board of Governors in November,¹⁸ it strengthened the partnerships and resource mobilization coordination mechanisms; undertook additional partnerships and resource mobilization efforts, particularly with non-traditional partners; strengthened internal information sharing, coordination mechanisms and tools; and enhanced staff members' capacity in partnerships and resource mobilization. The Secretariat also enhanced communication and outreach to external stakeholders; supported Member States in partnerships and resource mobilization activities; continued the Agency's existing collaboration arrangements; and developed new partnerships, particularly with Member State institutions to promote technology transfer, and with non-traditional partners such as international financial and regional organizations, the private sector, national and international professional organizations, and United Nations agencies and other international organizations.

Management of the Seibersdorf site

The Agency introduced an integrated framework to provide site-wide security, safety, infrastructure, maintenance, communication and outreach, and a broad spectrum of other support services to the Agency's laboratories in Seibersdorf. During the year it commissioned a master plan for the Seibersdorf site, a key component of the framework.

¹⁸ See *Report on the Implementation of Strategic Guidelines on Partnerships and Resource Mobilization* (GOV/INF/2017/13).