IAEA ANNUAL REPORT 2015

IAEA

60 Years

Atoms for Peace and Development

IAEA Annual Report 2015

Article VI.J of the Agency's Statute requires the Board of Governors to submit "an annual report to the General Conference concerning the affairs of the Agency and any projects approved by the Agency".

This report covers the period 1 January to 31 December 2015.

GC(60)/9
(Corrected)

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Member States of the International Atomic Energy Agency

(as of 31 December 2015)

AFGHANISTAN
ALBANIA
ALGERIA
ANGOLA
ANTIGUA AND BARBUDA
ARGENTINA
ARMENIA
AUSTRALIA
AUSTRIA
AZERBAIJAN
BAHAMAS
BAHRAIN
BANGLADESH
BARBADOS
BELARUS
BELGIUM
BELIZE
BENIN
BOLIVIA, PLURINATIONAL STATE OF
BOSNIA AND HERZEGOVINA
BOTSWANA
BRAZIL
BRUNEI DARUSSALAM
BULGARIA
BURKINA FASO
BURUNDI
CAMBODIA
CAMEROON
CANADA
CENTRAL AFRICAN REPUBLIC
CHAD
CHILE
CHINA
COLOMBIA
CONGO
COSTA RICA
CÔTE D'IVOIRE
CROATIA
CUBA
CYPRUS
CZECH REPUBLIC
DEMOCRATIC REPUBLIC OF THE CONGO
DENMARK
DJIBOUTI
DOMINICA
DOMINICAN REPUBLIC
ECUADOR
EGYPT
EL SALVADOR
ERITREA
ESTONIA
ETHIOPIA
FIJI
FINLAND
FRANCE
GABON
GEORGIA
GERMANY
GHANA
GREECE
GUATEMALA
GUYANA
HAITI
HOLY SEE
HONDURAS
HUNGARY
ICELAND
INDIA
INDONESIA
IRAN, ISLAMIC REPUBLIC OF
IRAQ
IRELAND
ISRAEL
ITALY
JAMAICA
JAPAN
JORDAN
KAZAKHSTAN
KENYA
KOREA, REPUBLIC OF
KUWAIT
KYRGYZSTAN
LAO PEOPLE'S DEMOCRATIC REPUBLIC
LATVIA
LEBANON
LESOTHO
LIBERIA
LIBYA
LIECHTENSTEIN
LITHUANIA
LUXEMBOURG
MADAGASCAR
MALAWI
MALAYSIA
MALI
MALTA
MARSHALL ISLANDS
MAURITANIA
MAURITIUS
MEXICO
MONACO
MONGOLIA
MONTENEGRO
MOROCCO
MOZAMBIQUE
MYANMAR
NAMIBIA
NEPAL
NETHERLANDS
NEW ZEALAND
NICARAGUA
NIGER
NIGERIA
NORWAY
OMAN
PAKISTAN
PALAU
PANAMA
PAPUA NEW GUINEA
PARAGUAY
PERU
PHILIPPINES
POLAND
PORTUGAL
QATAR
REPUBLIC OF MOLDOVA
ROMANIA
RUSSIAN FEDERATION
RWANDA
SAN MARINO
SAUDI ARABIA
SENEGAL
SERBIA
SEYCHELLES
SIERRA LEONE
SINGAPORE
SLOVAKIA
SLOVENIA
SOUTH AFRICA
SPAIN
SRI LANKA
SUDAN
SWAZILAND
SWEDEN
SWITZERLAND
SYRIAN ARAB REPUBLIC
TAJIKISTAN
THAILAND
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA
TOGO
TRINIDAD AND TOBAGO
TUNISIA
TURKEY
UGANDA
UKRAINE
UNITED ARAB EMIRATES
UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND
UNITED REPUBLIC OF TANZANIA
UNITED STATES OF AMERICA
URUGUAY
UZBEKISTAN
VANUATU
VENEZUELA, BOLIVARIAN REPUBLIC OF
VIET NAM
YEMEN
ZAMBIA
ZIMBABWE

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

The Agency at a Glance

(as of 31 December 2015)

167 Member States.

83 intergovernmental and non-governmental organizations worldwide invited to observe the Agency's General Conference.

59 years of international service.

2497 professional and support staff.

€352.1 million total Regular Budget for 2015.[1] Extrabudgetary expenditures in 2015 totalled **€85.8 million**.

€69.8 million target in 2015 for voluntary contributions to the Agency's Technical Cooperation Fund, supporting projects involving **3477** expert and lecturer assignments, **5126** meeting participants and other project personnel, **2722** participants in **175** regional and interregional training courses and **1852** fellows and scientific visitors.

138 countries and territories receiving support through the Agency's technical cooperation programme, including **35** least developed countries.

807 active technical cooperation projects at the end of 2015.

2 liaison offices (in New York and Geneva) and **2** safeguards regional offices (in Tokyo and Toronto).

12 international laboratories (Vienna, Seibersdorf and Monaco) and research centres.

11 multilateral conventions on nuclear safety, security and liability adopted under the Agency's auspices.

4 regional agreements relating to nuclear science and technology.

126 Revised Supplementary Agreements governing the provision of technical assistance by the Agency.

131 active CRPs involving **1686** approved research, technical and doctoral contracts and research agreements. In addition, **79** Research Coordination Meetings were held.

19 national donors to the voluntary Nuclear Security Fund.

181 States in which safeguards agreements were being implemented,[2,3] of which **127** States had additional protocols in force, with **2114** safeguards inspections performed in 2015. Safeguards expenditures in 2015 amounted to **€130.7 million** in the operational portion of the Regular Budget and **€27.0 million** in extrabudgetary resources.

20 national safeguards support programmes and **1** multinational support programme (European Commission).

430 000 visitors a month to the Agency's iaea.org site by the end of 2015, a 50% increase from 2014. The Agency's social media reach increased fivefold in 2015, growing to **5 million** people a month.

3.9 million records in the International Nuclear Information System (INIS), the Agency's largest database, with over **500 000** full texts not readily available through commercial channels and **2.3 million** page views in 2015.

1.1 million documents, technical reports, standards, conference proceedings, journals and books in the IAEA Library and over **14 000** visitors to the Library in 2015.

145 publications, including newsletters, issued in 2015 (in print and electronic formats).

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1 At the UN average rate of exchange of US $1.1091 to €1.00. The total Regular Budget was €356.4 million at the US $1.00 to €1.00 rate.

2 These 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.

3 And Taiwan, China.

The Board of Governors

The Board of Governors oversees the ongoing operations of the Agency. It comprises 35 Member States and generally meets five times a year, or more frequently if required for specific situations. Among its functions, the Board adopts the Agency's programme for the incoming biennium and makes recommendations on the Agency's budget to the General Conference.

In the area of nuclear technologies, in the course of 2015 the Board considered the *Nuclear Technology Review 2015.*

In the area of safety and security, the Board discussed the *Nuclear Safety Review 2015* and the *Report on the Fukushima Daiichi Accident*, and also debated the *Nuclear Security Report 2015.*

As regards verification, the Board considered *The Safeguards Implementation Report for 2014*. It approved one safeguards agreement. The Board kept under its consideration the issues of the implementation of the NPT Safeguards Agreement and relevant provisions of the United Nations Security Council resolutions in the Islamic Republic of Iran, the implementation of the NPT Safeguards Agreement in the Syrian Arab Republic and the application of safeguards in the Democratic People's Republic of Korea. The Board authorized the Director General to implement the necessary verification and monitoring of the Islamic Republic of Iran's nuclear-related commitments as set out in the Joint Comprehensive Plan of Action. The Board took note of the report on the *Final Assessment on Past and Present Outstanding Issues regarding Iran's Nuclear Programme* and adopted a resolution, in which, inter alia, it noted that all activities in the Road-map had been completed in accordance with the agreed schedule and that this closed its consideration of this item.

The Board discussed the *Technical Cooperation Report for 2014* and approved the Agency's technical cooperation programme for 2016.

The Board approved the *Strategic Guidelines on Partnerships and Resource Mobilization* as recommended by the Working Group on Resource Mobilization. The Board approved the recommendations contained in the *Proposal to the Board of Governors by the Co-Chairs of the Working Group on the Programme and Budget and the Technical Cooperation Fund Targets for 2016–2017*.

Composition of the Board of Governors (2015–2016)

Chair:

HE Mr. Laércio Antonio VINHAS
Ambassador
Governor from Brazil

Vice-Chairpersons:

HE Mr. Friedrich DÄUBLE
Ambassador
Governor from Germany

HE Mr. Bahtijors HASANS
Ambassador
Governor from Latvia

Argentina
Australia
Belarus
Brazil
Canada
Chile
China
Egypt
Finland
France
Germany
Ghana
India
Ireland
Japan
Korea, Republic of
Latvia
Malaysia
Mexico
Namibia
New Zealand
Nigeria
Pakistan
Paraguay
Philippines
Russian Federation
Saudi Arabia
South Africa
Spain
Switzerland
The former Yugoslav Republic of Macedonia
Turkey
United Kingdom of Great Britain and Northern Ireland
United States of America
Uruguay

The General Conference

The General Conference comprises all Member States of the Agency and meets once a year. It debates the annual report of the Board of Governors on the Agency's activities during the previous year, approves the Agency's financial statements and budget, approves any applications for membership, and elects members to the Board of Governors. It also conducts a wide ranging general debate on the Agency's policies and programmes and passes resolutions directing the priorities of the Agency's work.

In 2015, the Conference — upon the recommendation of the Board — approved Antigua and Barbuda, Barbados and Turkmenistan for membership of the Agency. At the end of 2015, the Agency's membership was 167.

Notes

- The *IAEA Annual Report for 2015* aims to summarize only the significant activities of the Agency during the year in question. The main part of the report, starting on page 25, generally follows the programme structure as given in *The Agency's Programme and Budget 2014–2015* (GC(57)/2).
- The introductory chapter, 'Overview', seeks to provide a thematic analysis of the Agency's activities within the context of notable developments during the year. More detailed information can be found in the latest editions of the Agency's *Nuclear Safety Review, Nuclear Security Report, Nuclear Technology Review, Technical Cooperation Report* and the *Safeguards Statement and Background to the Safeguards Statement*.
- Additional information covering various aspects of the Agency's programme is available, in electronic form only, on *iaea.org*, along with the *Annual Report*.
- The designations employed and the presentation of material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.
- The mention of names of specific companies or products (whether or not indicated as registered) does not imply any intention to infringe proprietary rights, nor should it be construed as an endorsement or recommendation on the part of the Agency.
- The term 'non-nuclear-weapon State' is used as in the Final Document of the 1968 Conference of Non-Nuclear-Weapon States (United Nations document A/7277) and in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The term 'nuclear-weapon State' is as used in the NPT.
- All the views expressed by Member States are reflected in full in the summary records of the June Board of Governors meetings. On 9 June 2016, the Board of Governors approved the Annual Report for 2015 for transmission to the General Conference.

Abbreviations

ABACC	Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials
AFRA	African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology
AFRA-NEST	AFRA Network for Education in Science and Technology
AGaRT	Advisory Group on Increasing Access to Radiotherapy Technology in Low and Middle Income Countries
ALMERA	Analytical Laboratories for the Measurement of Environmental Radioactivity
ANENT	Asian Network for Education in Nuclear Technology
AP	additional protocol
ARASIA	Regional Co-operative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology
ARCAL	Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean
CNS	Convention on Nuclear Safety
COP21	21st session of the Conference of the Parties (UNFCCC)
CPF	Country Programme Framework
CPPNM	Convention on the Physical Protection of Nuclear Material
CRP	coordinated research project
CSA	comprehensive safeguards agreement
ECAS	Enhancing Capabilities of the Safeguards Analytical Services
EED	environmental enteric dysfunction
ENEN	European Nuclear Education Network
EPR	emergency preparedness and response
EPREV	Emergency Preparedness Review
Euratom	European Atomic Energy Community
EVD	Ebola virus disease
FAO	Food and Agriculture Organization of the United Nations
GNSSN	Global Nuclear Safety and Security Network
HEU	high enriched uranium
ICTP	Abdus Salam International Centre for Theoretical Physics
INFCIRC	Information Circular (IAEA)
INIR	Integrated Nuclear Infrastructure Review
INIS	International Nuclear Information System
INLEX	International Expert Group on Nuclear Liability
INPRO	International Project on Innovative Nuclear Reactors and Fuel Cycles
INTERPOL	International Criminal Police Organization – INTERPOL
IPPAS	International Physical Protection Advisory Service
IRRS	Integrated Regulatory Review Service

ITDB	Incident and Trafficking Database (IAEA)
JCPOA	Joint Comprehensive Plan of Action
JPA	Joint Plan of Action
JPLAN	Joint Radiation Emergency Management Plan of the International Organizations
LANENT	Latin American Network for Education in Nuclear Technology
LEU	low enriched uranium
NESA	Nuclear Energy System Assessment
NGSS	next generation surveillance system
NPCs	National Participation Costs
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
OA-ICC	Ocean Acidification International Coordination Centre
OECD	Organisation for Economic Co-operation and Development
OECD/NEA	OECD Nuclear Energy Agency
ORPAS	Occupational Radiation Protection Appraisal Service
OSART	Operational Safety Review Team
PACT	Programme of Action for Cancer Therapy (IAEA)
PUI	Peaceful Uses Initiative
QUATRO	Quality Assurance Team for Radiation Oncology
RANET	Response and Assistance Network (IAEA)
RCA	Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology
ReNuAL	Renovation of the Nuclear Applications Laboratories
RSA	Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA
SALTO	Safety Aspects of Long Term Operation
SDG	Sustainable Development Goal
SIT	sterile insect technique
SQP	small quantities protocol
SSAC	State system of accounting for and control of nuclear material
SSDL	secondary standards dosimetry laboratory
STAR-NET	Regional Network for Education and Training in Nuclear Technology
TCF	Technical Cooperation Fund
UNDAF	United Nations Development Assistance Framework
UNEP	United Nations Environment Programme
WHO	World Health Organization

Overview

For almost six decades, the International Atomic Energy Agency has pursued the goal of making nuclear science and technology available to its Member States in a safe, secure and peaceful manner. Throughout this time, it has adapted its programme of work, within the framework of its Statute, to address the evolving needs and developmental goals of Member States.

The Agency's activities in 2015 were balanced across its main areas of work: technology transfer, safety and security, and verification. Throughout the year, the Agency supported its Member States in the use of nuclear science and technology to achieve their development goals and address a range of global challenges — from meeting growing energy needs and protecting the environment to improving food security and human health in a sustainable manner. At the same time, it worked to promote and strengthen global nuclear safety and nuclear security, and to contribute to non-proliferation by preventing the use of nuclear material and facilities for non-peaceful purposes. In this way, the Agency contributed to global peace, security and development, and made real improvements in the lives of people around the world.

The following is a report of the Agency's activities in 2015.

NUCLEAR TECHNOLOGY

Nuclear Power

Status and trends

The global generating capacity of nuclear energy grew in 2015, reaching 382.9 gigawatts (electrical) (GW(e)) at the end of the year. The number of operational nuclear power reactors increased to 441, with 10 new reactors connected to the grid in 2015, the highest number since 1993. During the year, construction started on 7 reactors — bringing to 67 the total number of reactors under construction around the world — and 7 reactors were permanently shut down.

"The global generating capacity of nuclear energy grew in 2015, reaching 382.9 gigawatts (electrical) (GW(e)) at the end of the year."

The Agency's projections for 2030 showed an increase in global nuclear power capacity of 2% in the low case scenario and 68% in the high case scenario. These projections were lower than those of 2014 owing to uncertainties concerning energy policy, licence renewals, reactor shutdowns and future construction. The figures take into account plant retirements; the actual new capacity added in the next 15 years will be about 150 GW(e) in the low and 300 GW(e) in the high case scenario. Near and long term growth prospects remained centred in Asia, with growth also expected in Africa, Eastern Europe and Latin America.

Major conferences

In June, the International Conference on the Management of Spent Fuel from Nuclear Power Reactors — An Integrated Approach to the Back End of the Fuel Cycle, held at the Agency's Headquarters in Vienna, attracted 207 participants from 39 Member States and 5 international organizations. Participants discussed key issues, including the safety of spent fuel management and spent fuel management strategies. The conference highlighted the need for an integrated approach to the back end of the fuel cycle, especially in the areas of processing, storage, transport and disposal, as well as the need to adopt a holistic view of spent fuel management.

In November, the Agency organized the International Conference on Research Reactors: Safe Management and Effective Utilization, its largest research reactor conference to date. Held in Vienna, the conference drew over 300 participants from 56 Member States. Among the conclusions were that operators should ensure the sustainability of research reactors through proper strategic planning, that they should integrate Agency safety standards and nuclear security guidance into their operations, and that they should make increased use of networking to learn from their peers.

Climate change and sustainable development

A new binding agreement on climate change was adopted at the 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21), held from 30 November to 11 December in Paris, France. The Paris Agreement recognizes that reductions in global greenhouse emissions are needed as soon as possible. At the same time, the need for energy worldwide is expected to grow. The Agency publication *Climate Change and Nuclear Power 2015*, launched in the run-up to COP21, describes how nuclear energy, as one of the low carbon energy sources available today, can help meet this 'climate–energy challenge'.

Energy assessment services

The Agency continued to provide energy assessment services to Member States, including assisting them, upon request, in conducting energy planning studies. Such studies help countries to evaluate how different technologies, including nuclear power, can potentially help them meet their energy needs. In 2015, the Agency continued to build Member State capacity for conducting Nuclear Energy System Assessments (NESAs) according to the methodology developed by the Agency's International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO). In 2015, a NESA was initiated in Malaysia and NESAs were under way in Indonesia, Romania and Ukraine.

Support to operating nuclear power plants

Many operators have made investments to enhance the safety and security and improve the reliability of their nuclear power plants, while at the same time facing increased operational costs and low electricity prices. This has an impact on the cost of nuclear power generation and may affect the economic sustainability of long term operation of plants. A Technical Meeting with 35 participants from 16 Member States, held in May in Helsinki, Finland, assessed such economic impacts and defined the technical, management and external cost drivers affecting long term operation.

Launching nuclear power programmes

To improve support to 'newcomer' countries — some thirty Member States that are currently considering or planning a nuclear power programme — the lessons learned from the first six years of Integrated Nuclear Infrastructure Review (INIR) missions were reviewed and published. The Agency also updated Country Nuclear Infrastructure Profiles and integrated work plans for several countries, which were then used in planning its 2016–2017 activities. In 2015, INIR missions were conducted to Kenya, Morocco and Nigeria.

Capacity building, knowledge management and nuclear information

The Agency provided a variety of support to newcomer countries and to Member States with established nuclear power programmes throughout the year. It held Technical Meetings, provided training, conducted Nuclear Knowledge Management Schools and Nuclear Energy Management Schools, and carried out missions and activities to support networks, focusing in particular on capacity building, human resource development, training, knowledge management, stakeholder involvement, learning management systems and e-learning. The Agency's largest database, the International Nuclear Information System (INIS), grew to almost 3.9 million records, with 1.9 million document downloads in 2015. Membership in the International Nuclear Library Network, coordinated by the IAEA Library, increased to 55 partners, up from 52 in 2014.

"the International Nuclear Information System (INIS), grew to almost 3.9 million records, with 1.9 million document downloads in 2015."

Assurance of supply

Major milestones were reached in the IAEA Low Enriched Uranium (LEU) Bank project in 2015. In June, the Board of Governors approved an agreement with Kazakhstan to establish in Kazakhstan the IAEA LEU Bank, and authorized the Director General to implement it; the Board also approved a draft agreement with the Russian Federation regarding the transit of the Agency's LEU through its territory to and from the IAEA LEU Bank, and authorized the Director General to conclude and implement it. The transit agreement was signed with the Russian Federation in June, and the Host State Agreement and two subsidiary technical agreements were signed with Kazakhstan in August. Significant technical work continued in the areas of safety — specifically seismic safety — and security. A feasibility study was completed on storage facility options and a new building came into consideration.

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

Support to fuel cycle activities

To assist Member States in identifying and extracting uranium resources, the Agency organized ten Technical Meetings and training workshops on uranium exploration, resources and production, and social and environmental responsibility aspects of mining activities. It also held 11 Technical Meetings and consultancy meetings focusing on various topics related to fuel engineering and spent fuel management; the meetings reaffirmed the findings of the International Conference on the Management of Spent Fuel from Nuclear Power Reactors held in June.

Technology development and innovation

The Agency continued to focus on activities aimed at addressing the potential challenges for deployment of advanced reactors in the near term. Throughout 2015, it provided a variety of support to Member States and various stakeholders involved in developing and designing innovative nuclear systems. For advanced water cooled reactor technologies,

efforts were focused on research and innovation activities in the light of the accident at the Fukushima Daiichi nuclear power plant, and on supporting Member States in addressing design, deployment, safety and regulatory issues of small and medium sized or modular reactors. For innovative systems such as fast and gas cooled reactors, the focus was on the development of specific safety systems and adequate safety design criteria and guidelines, and on knowledge management and education and training. Guided by Member State requests and recent General Conference resolutions, the Agency also increased its efforts to support research and development and the exchange of information on various non-electrical applications such as seawater desalination, hydrogen production, cogeneration and industrial applications. The development and maintenance of dedicated toolkits for such applications were another focus of Agency activities. Two INPRO Dialogue Forums, held at the Agency's Headquarters in May and October, addressed cooperative approaches to the back end of the nuclear fuel cycle and road maps for transition to globally sustainable nuclear energy systems.

Research reactors

The Agency assisted Member States in various aspects of planning, construction, operation, maintenance and utilization of research reactors through training and outreach activities, new publications, and support to networks and coalitions. It continued to assist Member States, upon request, in minimizing the civilian use of high enriched uranium (HEU) by supporting conversion of research and test reactors from the use of HEU fuel to LEU fuel and the repatriation of HEU to its country of origin. During the 59th regular session of the Agency's General Conference, the Director General designated the Research Centres of Saclay and Cadarache of the French Alternative Energies and Atomic Energy Commission as the first 'IAEA-designated International Centre based on Research Reactor' (ICERR).

Nuclear fusion

Nuclear fusion is being pursued as a potential energy source of the future by several countries, both individually and collectively through ITER. With ITER construction fully under way, the Agency continued its activities to support the consolidation of some of ITER's design choices through Technical Meetings and coordinated research projects. The Agency's series of DEMO (Demonstration Fusion Power Plant) Programme Workshops provided a framework for coordinating Member State programmes aimed at demonstrating industrial scale electricity production from fusion.

Nuclear data

The Agency's databases of nuclear, atomic and molecular data received more than two million hits per month in 2015. In addition, almost 260 000 datasets and documents were downloaded in that time period.

Accelerator applications

The Agency continued to build capacity in Member States by providing training and facilitating research using large accelerators such as synchrotrons. In 2015, the Agency established the Accelerator Knowledge Portal, a community driven web site for the benefit of accelerator scientists, accelerator users and service providers worldwide. Together with the American Nuclear Society, the Agency organized the 12th International Topical Meeting on Nuclear Applications of Accelerators, held in November in Washington, DC, United States of America.

Nuclear instrumentation

Through its Nuclear Science and Instrumentation Laboratory, the Agency continued to provide high quality training and to develop instruments to meet the specific needs of Member States. During the year, fellows from several Member States received hands-on training in effective utilization of nuclear instrumentation for environmental and other applications. Also in 2015, a rapid environmental radioactivity mapping system using unmanned aerial vehicles on a customized hexacopter was developed for use in Japan's Fukushima Prefecture, where testing is under way. Such detection systems can help Member States to monitor radiation after mining or remediation activities.

NUCLEAR SCIENCES AND APPLICATIONS

Nuclear sciences and applications continued to play a vital role across a range of important socioeconomic sectors in 2015. In a number of areas — from food and agriculture, human health and the environment to water resources and industry — Agency scientists worked with experts in Member States to help meet development needs through nuclear science, technology and innovation.

Renovation of the Nuclear Applications Laboratories (ReNuAL)

The Renovation of the Nuclear Applications Laboratories (ReNuAL) project made substantial progress in 2015. An expert review in February endorsed the conceptual designs of the new laboratory buildings. The functional designs of the new laboratory buildings, yielding more refined details and cost estimates, were completed in August, and in September the site was prepared for construction. During the year, the Agency procured equipment to improve the capabilities of four of the Agency laboratories in Seibersdorf using approximately €1.5 million provided for this purpose. Over €10.3 million in extrabudgetary funds was raised in 2015[1] to support the project, creating a sound basis for construction of the new buildings and infrastructure starting in 2016.

Nuclear Olympiad

In 2015, as part of its outreach activities, the Agency organized a Nuclear Olympiad in cooperation with the World Nuclear University. The event challenged university students in nuclear science related fields from around the world to create 60-second videos illustrating how nuclear techniques can be used for global development.

Food and Agriculture

Emerging and re-emerging zoonotic diseases

Recent outbreaks of diseases such as Ebola virus disease (EVD) and H5N1 influenza in human populations, and Rift Valley fever, African swine fever, peste des petits ruminants and foot-and-mouth disease in animal populations point to the need for wider use of tools for early and rapid disease diagnosis and control. In 2015, the Agency delivered an extensive technological animal health package to Member States in Africa affected by EVD to detect and respond to outbreaks of the disease at the animal–human interface. During

"the Agency delivered an extensive technological animal health package to Member States in Africa affected by EVD to detect and respond to outbreaks of the disease at the animal–human interface."

[1] In 2015, financial contributions were received from Australia, China, Germany, India, Israel, Japan, the Republic of Korea, Kuwait, Mongolia, Norway, Pakistan, the Philippines, South Africa, Spain, Switzerland, the United Kingdom and the United States of America.

the year, the Agency's Board of Governors approved an off-cycle technical cooperation project targeting emerging zoonotic diseases (including EVD). Seventeen participants from nine Member States attended two training courses — held in Cameroon in August and Uganda in December — aimed at enhancing biosecurity during sample collection, packing and shipment.

Soil and water management and crop nutrition

To commemorate the International Year of Soils, the Agency held a side event during the 59th regular session of its General Conference in September entitled 'Managing Soils for Climate-Smart Agriculture', highlighting ongoing work on soil management and its important contribution to global food security. In December, the Agency and the International Union of Soil Sciences held a one day conference commemorating World Soil Day. Participants adopted the Vienna Soil Declaration, which sets out a framework for future research in soil science and links achievements to the Sustainable Development Goals (SDGs) and to global efforts to combat climate change. An article on the Agency's work on the use of fallout radionuclides and compound specific stable isotopes to measure soil erosion and to determine sources of land degradation was published in *National Geographic* in December. The piece highlights how these nuclear techniques can help to curtail the threat of soil erosion to ensure sustainable agricultural management.

Human Health

IPET-2015

The Agency hosted the International Conference on Clinical PET–CT and Molecular Imaging: PET–CT in the Era of Multimodality Imaging and Image Guided Therapy (IPET-2015) in Vienna in October. This unique, multidisciplinary conference supported the development of comprehensive approaches to patient care by bringing together over 500 professionals from 95 Member States, working in different fields and regions of the world, to discuss the current status of and trends in nuclear medicine, radiology and radiopharmaceutical sciences. Participants explored important clinical aspects of specific diseases and conditions, and the role of positron emission tomography–computed tomography (PET–CT) and other imaging modalities in providing appropriate diagnostics and treatment.

Use of electronic and digital tools in radiation medicine

The Agency assists Member States in using communication technology to improve radiation medicine services. Technology such as on-line platforms can be used for peer review to allow medical experts to discuss and review plans or treatments and to learn from other experts. During the 59th regular session of the General Conference, the Agency released a cancer staging app for iPhone and Android devices. This TNM (tumour, lymph node, metastasis) app, developed by the Agency in collaboration with the Tata Memorial Centre under the Government of India's Department of Atomic Energy, is easy to use and is available free of charge. The app enables physicians around the world to carry out cancer staging both on- and off-line.

Water Resources Management

In May, the Agency hosted the 14th International Symposium on Isotope Hydrology: Revisiting Foundations and Exploring Frontiers, which was attended by over 400 professionals from 84 Member States. The participants reviewed the current state of

the science of isotope applications and helped to identify research, analytical and training requirements to support the wider use of isotope hydrology for sustainable development. As groundwater is the largest reservoir of fresh water on earth, global groundwater depletion poses a significant threat to water security. In this context, in 2015 the Agency focused on research, training, protocol development and analytical services aimed at expanding the use of groundwater age dating with isotopes to map water resources.

Environment

Ocean acidification is a growing global concern and a specific target under the SDG on oceans and seas. In 2015, the Agency, through its Ocean Acidification International Coordination Centre (OA-ICC), increased capacity building and communication and outreach activities in this area, and helped to advance ocean acidification science. In January, the OA-ICC, in cooperation with the Scientific Centre of Monaco, brought together leading experts from around the world to discuss the science and socioeconomic impacts of ocean acidification, the effects it has on communities and the actions that policy makers can take to address it. The results of the meeting were presented on World Oceans Day, in June, and during a side event at COP21, in December. The Agency continued to strengthen its work in areas where ocean acidification data are scarce and where the problem is most severe. Regional training courses on ocean acidification were organized in China and South Africa, providing training to 54 participants from 27 Member States. The courses also provided a forum for preliminary discussions on the creation of regional ocean acidification networks in Asia and Africa.

"Regional training courses on ocean acidification were organized in China and South Africa, providing training to 54 participants from 27 Member States."

Radioisotope Production and Radiation Technology

Radioisotope production

The possible shortage of molybdenum-99 (^{99}Mo) — the parent of technetium-99m (^{99m}Tc), the most widely employed radioisotope in nuclear medicine — continues to be a major concern around the world. This issue was addressed in a coordinated research project entitled 'Accelerator-based Alternatives to Non-HEU Production of ^{99}Mo/^{99m}Tc'. The project, which concluded in 2015, resulted in the demonstration of an alternative technology for producing ^{99m}Tc using medical cyclotrons. If widely implemented, the new technology can enhance security of the global medical radioisotope supply.

SCIENTIFIC FORUM 2015

Radiation technologies are increasingly being applied to improve the quality of products used in daily life, from car tires to medical devices to building materials. At the 2015 Scientific Forum on 'Atoms in Industry: Radiation Technology for Development', held at the Agency's Headquarters during the 59th regular session of the General Conference, leading experts, academics and industrial representatives outlined the many benefits these techniques offer, in particular boosting productivity in environmentally friendly ways.

The forum highlighted how radiation can be used to kill germs to sterilize medical equipment used in lifesaving procedures, produce more effective vaccines and make tissue grafts safe for transplants. The use of radiation technologies in the treatment of pollution, such as industrial pollutants and flue gas, was also showcased.

NUCLEAR SAFETY AND SECURITY

Nuclear Safety

The global nuclear community made further progress in strengthening and improving safety in 2015. The challenges faced by Member States during the year highlighted the importance of ongoing international collaboration, cooperation and capacity building. The Agency continued to assist Member States in building capabilities and worked to strengthen the nuclear safety and security framework globally through national and international programmes and activities.

Progress on the IAEA Action Plan on Nuclear Safety

The Agency continued to analyse the relevant technical aspects of the Fukushima Daiichi accident and to share lessons learned with the wider nuclear community. In February, the Agency, in cooperation with the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), organized the International Experts Meeting on Strengthening Research and Development Effectiveness in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant, which was attended by 150 experts, representing 38 Member States and 5 international organizations. It also organized, in April, the International Experts Meeting on Assessment and Prognosis in Response to a Nuclear or Radiological Emergency, which drew 200 experts from 70 countries and 5 international organizations.

During the year, the Agency published four reports in connection with the IAEA Action Plan on Nuclear Safety: the *IAEA Report on Severe Accident Management in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant*[2]; the *IAEA Report on Strengthening Research and Development Effectiveness in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant*[3]; the *IAEA Report on Assessment and Prognosis in Response to a Nuclear or Radiological Emergency*[4]; and the *IAEA Report on Capacity Building for Nuclear Safety*[5].

"In September, the Director General's report on the Fukushima Daiichi accident was released, along with five technical volumes."

In September, the Director General's report on the Fukushima Daiichi accident was released, along with five technical volumes. The report and the technical volumes were the result of an extensive international collaborative effort involving 5 working groups of some 180 experts from 42 Member States with and without nuclear power programmes, and several international organizations. They provide a description of the accident and its causes, evolution and consequences, based on the evaluation of data and information from many sources, including the results of the work carried out in implementing the Action Plan. The Government of Japan and various Japanese organizations provided a significant amount of data.

The Director General's fourth and final annual report on the Action Plan, *Progress in the Implementation of the IAEA Action Plan on Nuclear Safety*,[6] and its supplement[7] were submitted to Member States in September 2015. The Agency will continue to implement dedicated projects related to elements of the Action Plan in the context of the regular programme of work.

2 Available at: *https://www.iaea.org/sites/default/files/iem7-severe-accident-management.pdf.*

3 Available at: *https://www.iaea.org/sites/default/files/iem8-report-on-research-and-development.pdf.*

4 Available at: *https://www.iaea.org/sites/default/files/iem9-assessment-and-prognosis.pdf.pdf.*

5 Available at: *https://www.iaea.org/sites/default/files/report-on-capacity-building.pdf.*

6 Available at: *https://www.iaea.org/About/Policy/GC/GC59/GC59InfDocuments/English/gc59inf-5_en.pdf.*

7 Available at: *https://www.iaea.org/About/Policy/GC/GC59/GC59InfDocuments/English/gc59inf-5-att1_en.pdf.*

Improving regulatory effectiveness

The Agency's Integrated Regulatory Review Service (IRRS) enables Member States with and without nuclear power plants to evaluate the effectiveness of their national safety regulatory bodies using self-assessment and peer review. As part of the evaluation, regulatory, technical and policy practices are compared against Agency safety standards and, where appropriate, good practices elsewhere. In 2015, the Agency conducted eight IRRS missions, to Armenia, Croatia, Hungary, India, Indonesia, Ireland, Malta and the United Republic of Tanzania, and four IRRS follow-up missions, to Finland, Slovakia, Switzerland and the United Arab Emirates. In addition, four IRRS preparatory missions were conducted to Member States with nuclear power plants (Bulgaria, Finland, Japan and Sweden), and five IRRS preparatory missions were conducted to Member States without operating nuclear power plants (Belarus, Guatemala, Ireland, Lithuania and the United Republic of Tanzania).

Operation of nuclear power plants and research reactors

Managing the long term operation of both power reactors and research reactors continued to be a major focus of Member States in 2015. By the end of the year, around 40% of the 441 nuclear power reactors operating in the world had been in operation for 30 to 40 years and another 16% had been in operation for more than 40 years. During the year, the Agency conducted four Safety Aspects of Long Term Operation (SALTO) peer review service missions, to Belgium, China, Mexico and South Africa.

In 2015, the Agency also carried out six Operational Safety Review Team (OSART) missions, to Canada, France, Japan, Pakistan, the Russian Federation and the United Kingdom; two OSART follow-up missions, to France and the United States of America; and one Corporate OSART follow-up mission, to the Czech Republic. The Agency also revised the 2005 edition of the *OSART Guidelines* and piloted the updated guidelines during the OSART missions conducted in 2015.

New and expanding nuclear power programmes

In 2015, feedback from Agency peer reviews, expert missions, workshops and other assistance activities indicated that Member States embarking on a nuclear power programme continued to experience challenges in establishing an adequate and effective regulatory body with a sufficient number of competent staff. In particular, the Agency's review services continued to identify delays in the development of the regulatory framework, especially the establishment of the licensing process and regulatory inspection programmes.

Throughout the year, the Agency provided Member States embarking on a nuclear programme with a range of services offered as part of the Agency's Safety Assessment Advisory Programme (SAAP) as well as training programmes aimed at improving safety infrastructure. In 2015, the Agency conducted a SAAP mission to Malaysia and provided training in the use of thermohydraulic analysis codes to 30 participants in a course held in Jordan.

Major outcomes of key nuclear safety conferences in 2015

In June, the Agency hosted the International Conference on Operational Safety to seek further opportunities to improve operational safety worldwide. The conference, held in Vienna, was attended by 180 participants from 44 Member States, who highlighted the important role of OSART missions in promoting the application of the Agency's safety standards. Conference participants also identified challenges in the following areas:

corporate management of safety; leadership and safety culture; operational experience; and long term operation of nuclear power plants.

In October, over 420 participants from 82 Member States and 18 international organizations attended the International Conference on Global Emergency Preparedness and Response, held at the Agency's Headquarters in Vienna. The conference covered topics such as international cooperation, communication, past emergencies, and education and training, in order to share knowledge and strengthen national systems. Experts in emergency preparedness and response (EPR) discussed challenges and identified key priorities for further improving readiness to respond to nuclear and radiological emergencies.

"In October, over 420 participants from 82 Member States and 18 international organizations attended the International Conference on Global Emergency Preparedness and Response, held at the Agency's Headquarters in Vienna."

Occupational radiation protection

As the use of ionizing radiation in occupational settings expands around the world, the number of occupationally exposed workers continues to increase. Two important measures that Member States can take to reduce occupational exposures are to build capacity for individual monitoring and to support the implementation of the Agency's safety standards by end users. In 2015, the Agency carried out a number of activities to assist Member States in this regard. In May, an international symposium on radiation protection in nuclear power plants, co-sponsored by the Agency and the OECD/NEA, was held in Brazil. The event attracted some 70 participants from 15 countries, who shared experience of source term management. The symposium considered in detail information on occupational exposure in Brazil and the Republic of Korea and the impact of alpha emitting radionuclides on radiation protection at nuclear power plants. In October, the Agency organized the Second International Workshop on Developing Guidance Material to Support Safety Standards Applicable to the Uranium Mining and Processing Industry. The workshop, held in Australia, addressed radiation protection issues concerning radon and future uranium supply needs and was attended by 30 participants from 7 Member States. The participants discussed the challenges faced by regulators, operators and workers in implementing the new occupational radiation protection requirements established in *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards* (IAEA Safety Standards Series No. GSR Part 3). During the year, the Agency published a Safety Report entitled *Radiation Protection of Itinerant Workers* (Safety Reports Series No. 84) and *Naturally Occurring Radiation Material (NORM VII)*, the proceedings of an international symposium.

Incident and emergency preparedness and response

In line with its specific functions under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the Agency continued to assist Member States in strengthening EPR arrangements in 2015. During the year, it developed technical and practical guidance for Member States, and provided training and expert and Emergency Preparedness Review (EPREV) services. In November, it published the revised requirements for preparedness and response for a nuclear or radiological emergency in the new General Safety Requirements publication *Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSR Part 7). It also conducted five EPREV missions in 2015, to Ghana, Jamaica, Kenya, Nigeria and the United Arab Emirates, and two preparatory EPREV missions, to Ghana and Hungary.

The Agency launched the Emergency Preparedness and Response Information Management System (EPRIMS) during the 59th regular session of the General Conference in September. Use of this system will enhance the effectiveness and usefulness of EPR self-assessment and of EPREV peer reviews. EPRIMS is a web based tool that allows Member States to record information about their EPR arrangements, perform self-assessments of their status with reference to the recommendations outlined in the Agency safety standards

on EPR and, at their discretion, share information and knowledge with the Agency and other Member States. EPRIMS features a database of nuclear power plants in Member States and associated technical data. The database is linked to the Agency's Power Reactor Information System, making the tool instrumental in the assessment and prognosis process in response to a nuclear or radiological emergency.

In 2015, the Emergency Preparedness and Response Standards Committee (EPReSC) was established under the Agency's Commission on Safety Standards and held its first meeting from 30 November to 2 December. EPReSC focuses on EPR aspects of the Agency's programme for the development, review and revision of safety standards, and advises on the activities supporting the use and application of these standards.

Strengthening global, regional and national networks

Knowledge networks continued to grow and played an integral part in the Agency's support of capacity building in Member States during the year. In 2015, the SMR Regulators' Forum was created and joined the Agency's Global Nuclear Safety and Security Network (GNSSN). This new forum is the first to specifically address regulatory issues in the safety and licensing of small modular reactors (SMRs). The GNSSN platform now links 20 international and regional networks. Moreover, the Agency began discussions with various international groups in Europe and Central Asia on establishing a new regional safety network under the GNSSN with a view to involving those countries that currently are not members of any safety network. In 2015, further development of regional networks for transport safety was a primary focus for the Agency. Efforts continued aimed at strengthening existing networks in Africa, Asia, the Caribbean, the Mediterranean and the Pacific Islands.

Code of Conduct on the Safety and Security of Radioactive Sources

The Agency organized an International Meeting on Facilitation of States' Political Commitment to and Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources. Held in Vienna in November, the meeting was attended by 21 experts from 17 Member States. The event provided an opportunity for those States that have not yet expressed political commitment to the Code to gain a better understanding of the Code and to learn from other Member States about the benefits and the challenges associated with implementing its provisions.

Conventions

On 9 February 2015, a diplomatic conference was convened to consider a proposal by Switzerland to amend Article 18 of the Convention on Nuclear Safety (CNS) addressing the design and construction of both existing and new nuclear power plants. The conference thoroughly considered the Swiss proposal and concluded that it would not be possible to reach consensus on the proposed amendment. Instead, in order to achieve the same objective as the proposed amendment, the Contracting Parties unanimously adopted the Vienna Declaration on Nuclear Safety, which includes "principles to guide them, as appropriate, in the implementation of the objective of the CNS to prevent accidents with radiological consequences and mitigate such consequences should they occur".

The Fifth Review Meeting of the Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was held in May 2015. The Contracting Parties discussed, in particular, the progress made since the Fourth Review Meeting with regard to the management of disused sealed sources; the safety implications of very long storage periods and delayed disposal of spent fuel and radioactive waste; and international cooperation in finding solutions for the long

term management and disposal of different types of radioactive waste and spent fuel. The Contracting Parties highlighted the contribution of the Joint Convention towards enhancing the level of safety worldwide for the management of spent fuel and radioactive waste.

The Convention on Supplementary Compensation for Nuclear Damage (CSC), which was adopted on 12 September 1997 at the same time as the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage, entered into force on 15 April 2015.

Civil liability for nuclear damage

The International Expert Group on Nuclear Liability (INLEX) continues to serve as the Agency's main forum for questions related to nuclear liability. The 15th Meeting of INLEX took place in Vienna, from 28 to 30 April 2015.

The Group discussed, inter alia, the issue of liability and insurance provisions covering radioactive sources; the implications of the entry into force of the CSC; a proposal to revise a paper issued by INLEX in 2013 on the benefits of joining the international nuclear liability regime and corresponding key messages; the revision of the model provisions on nuclear liability in the *Handbook on Nuclear Law: Implementing Legislation*; and outreach activities. Regarding liability and insurance provisions covering radioactive sources, the Group recommended that licences for at least Category 1 and 2 sources include a requirement that the licensee take out insurance coverage or other financial security. However, in view of questions raised regarding the availability of such insurance in developing countries, the Group decided, at the same time, to keep the matter under review.

The Fourth Workshop on Civil Liability for Nuclear Damage was held in Vienna on 27 April 2015 and was attended by 65 participants from 38 Member States. The purpose of the workshop was to provide diplomats and experts from Member States with an introduction to the international legal regime of civil liability for nuclear damage.

Other outreach activities in 2015 included two joint IAEA–INLEX missions, to Jordan and Mexico, to raise awareness of the international legal instruments relevant for achieving a global nuclear liability regime. In addition, a Subregional Workshop for Caribbean Countries on Civil Liability for Nuclear Damage was held in Panama City, Panama, in June to provide participants with information on the existing international nuclear liability regime and to advise on the development of national implementing legislation. The event was attended by 31 participants from 14 Member States.

Nuclear Security

The Agency continued to contribute to global efforts to secure nuclear facilities and to ensure the security of radioactive material in use, storage or transport. Throughout the year, the Agency supported States, upon request, in their efforts to meet their national responsibilities and international obligations through its implementation of the *Nuclear Security Plan 2014–2017*. The Agency also encouraged and assisted States to adhere to relevant international instruments; continued efforts aimed at completing international guidance in the IAEA Nuclear Security Series; and built on the progress made during previous years to help States sustain and further improve their national nuclear security regimes. The need for these continued efforts to improve nuclear security worldwide was clearly demonstrated by General Conference resolutions and requests for assistance. The support of activities to improve physical protection measures in States remained a high priority. In response to Member State requests, the Agency published four Implementing Guides during the year, including one on nuclear forensics. Member States continued to request security advisory services, in particular the International Physical Protection Advisory Service (IPPAS), which assists States in strengthening their national security infrastructure relating to physical protection; the Agency conducted four IPPAS missions in 2015, to Canada, Japan, New Zealand and Norway.

Conventions

In 2015, the Agency continued to give priority to promoting the entry into force of the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM). During the year, seven States adhered to the Amendment (Botswana, Iceland, Italy, Morocco, San Marino, Turkey and the United States of America). At the end of 2015, a total of 90 States (and one international organization) had joined the Amendment and a further 12 CPPNM States Parties were needed for it to enter into force. In December, the Agency held the first meeting for Points of Contact and Central Authorities of States Parties to the CPPNM.

Capacity building in nuclear security

Human resource development continues to be regarded as essential for the sustainability of nuclear security regimes. In the course of the year, the Agency conducted 108 training courses and workshops (23 regional or international, and 85 national), at which 2315 participants were trained in all aspects of nuclear security. In addition, one Member State established a master's course in nuclear security using the Agency's syllabus. To enhance national capacities to detect material out of regulatory control, the Agency donates detection instruments to States. In the course of 2015, the Agency donated some 780 detection instruments, including four portal monitors.

"In the course of the year, the Agency conducted 108 training courses and workshops ... at which 2315 participants were trained in all aspects of nuclear security."

International Conference on Computer Security in a Nuclear World

In June, the Agency hosted its first conference on computer security. Around 700 experts from 92 Member States and 17 regional and international organizations attended the International Conference on Computer Security in a Nuclear World: Expert Discussion and Exchange, held at the Agency's Headquarters in Vienna. Organized in cooperation with the International Criminal Police Organization – INTERPOL, the International Telecommunication Union, the United Nations Interregional Crime and Justice Research Institute, and the International Electrotechnical Commission, the conference included representatives of nuclear regulators and plant operators, law enforcement agencies, and system and security vendors. Experts concluded that computer security is an essential element in nuclear security to guard against increasingly sophisticated on-line threats in a digitally dependent and interconnected environment.

NUCLEAR VERIFICATION[8,9]

Implementation of safeguards in 2015

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.

[8] 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.

[9] 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.

In 2015, safeguards were applied for 181 States[10,11] with safeguards agreements in force with the Agency[12]. Of the 121 States that had both a comprehensive safeguards agreement (CSA) and an additional protocol (AP) in force, the Agency concluded that *all* nuclear material remained in peaceful activities in 67 States[13]; for 54 States, as the necessary evaluation regarding the absence of undeclared nuclear material and activities for each of these States remained ongoing, the Agency was unable to draw the same conclusion. For these 54 States, and for the 52 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 that *all* nuclear material has remained in peaceful activities has been drawn, the Agency implements integrated safeguards: an optimized combination of measures available under CSAs and APs to maximize effectiveness and efficiency in fulfilling the Agency's safeguards obligations. By the end of 2015, integrated safeguards were implemented for 54 States.

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.

As of 31 December 2015, 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 additional protocols, and amendment and rescission of small quantities protocols

In 2015, the Agency continued to implement the *Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols*[14], which was updated in September 2015. During 2015, three APs entered into force,[15] one comprehensive safeguards agreement with a small quantities protocol (SQP) based on the revised SQP text entered into force,[16] one State[17] signed a comprehensive safeguards agreement with an SQP, one operational SQP was amended,[18] and three SQPs were rescinded.[19] By the end of the year, safeguards agreements were in force with 182 States and APs were in force with 127 States. Moreover, 60 States of some 100 States had accepted the revised SQP text (which was in force for 54 of these States) and 7 States had rescinded their SQPs.

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10 These 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..

11 And Taiwan, China.

12 The status with regard to the conclusion of safeguards agreements, additional protocols and small quantities protocols is given in the Annex to this report.

13 And Taiwan, China.

14 Available at: *https://www.iaea.org/sites/default/files/final_action_plan_1_july_2014_to_30_june_2015.doc.pdf.*

15 Cambodia, Djibouti and Liechtenstein.

16 Djibouti.

17 Federated States of Micronesia.

18 Togo.

19 Azerbaijan, Jordan and Tajikistan.

Islamic Republic of Iran (Iran)

During 2015, the Director General submitted four reports to the Board of Governors entitled *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran* (GOV/2015/15, GOV/2015/34, GOV/2015/50 and GOV/2015/65).

In 2015, Iran continued to conduct enrichment related activities, although it did not produce uranium hexafluoride enriched above 5% uranium-235. Iran also continued work on heavy water related projects. However, it neither installed any major components at the IR-40 Reactor nor produced nuclear fuel assemblies for the IR-40 Reactor at the Fuel Manufacturing Plant[20].

On 14 July 2015, the Director General and the Vice-President of Iran and President of the Atomic Energy Organization of Iran, HE Ali Akbar Salehi, signed in Vienna a Road-map for the clarification of past and present outstanding issues regarding Iran's nuclear programme (GOV/INF/2015/14). The Road-map identified the necessary activities to be undertaken under the Framework for Cooperation in order to accelerate and strengthen cooperation and dialogue between the Agency and Iran aimed at the resolution, by the end of 2015, of all past and present outstanding issues — as set out in the annex to the Director General's report of November 2011 (GOV/2011/65) — that had not already been resolved by the Agency and Iran.

The activities set out in the Road-map, including technical-expert meetings and the conduct of safeguards activities by the Agency at particular locations in Iran, were completed on schedule. The implementation of the Road-map facilitated a more substantive engagement between the Agency and Iran.

On 2 December 2015, the Director General provided a report to the Board of Governors on the *Final Assessment on Past and Present Outstanding Issues regarding Iran's Nuclear Programme* (GOV/2015/68). The Agency assessed that a range of activities relevant to the development of a nuclear explosive device had been conducted in Iran prior to the end of 2003 as a coordinated effort, and some activities took place after 2003. The Agency also assessed that these activities had not advanced beyond feasibility and scientific studies, and the acquisition of certain relevant technical competences and capabilities. The Agency had no credible indications of activities in Iran relevant to the development of a nuclear explosive device after 2009 and found no credible indications of the diversion of nuclear material in connection with the possible military dimensions to Iran's nuclear programme.

On 15 December 2015, the Board of Governors adopted resolution GOV/2015/72, in which, inter alia, it noted that all activities in the Road-map had been completed in accordance with the agreed schedule and that this closed its consideration of this item.

Throughout 2015, the Agency continued to undertake monitoring and verification in relation to the nuclear-related measures set out in the Joint Plan of Action agreed between China, France, Germany, the Russian Federation, the United Kingdom, the United States of America (E3+3) and Iran, the aim of which was to reach a "mutually-agreed, long-term comprehensive solution that would ensure Iran's nuclear programme will be exclusively peaceful". The Joint Plan of Action was extended three times, most recently on 30 June 2015, when the E3+3 and Iran requested the Agency, on behalf of the E3/EU+3 and Iran, to continue to undertake the necessary nuclear-related monitoring and verification activities in Iran under the Joint Plan of Action until further notice.

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[20] In 2015, Iran was required by relevant binding resolutions of the Board of Governors and the United Nations Security Council to implement the modified Code 3.1 of the Subsidiary Arrangements General Part to its Safeguards Agreement; suspend all enrichment-related and reprocessing activities; and suspend all heavy water related activities. Security Council resolution 2231 (2015), adopted in July 2015, included terms providing for the termination of the provisions of six Security Council resolutions adopted between 2006 and 2010.

On 14 July 2015, the E3/EU+3 and Iran agreed on a Joint Comprehensive Plan of Action (JCPOA), stating that "the full implementation of this JCPOA will ensure the exclusively peaceful nature of Iran's nuclear programme". In August 2015, the Board of Governors, inter alia, authorized the Director General to implement the necessary verification and monitoring of Iran's nuclear-related commitments as set out in the JCPOA, and report accordingly, for the full duration of those commitments in light of United Nations Security Council resolution 2231 (2015), subject to the availability of funds and consistent with the Agency's standard safeguards practices; and authorized the Agency to consult and exchange information with the Joint Commission, as set out in the Director General's report on *Verification and Monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015)* (GOV/2015/53 and Corr.1 thereto). After Adoption Day, the Agency began conducting preparatory activities related to the verification and monitoring of Iran's nuclear-related commitments under the JCPOA.

In October 2015, Iran informed the Agency pursuant to paragraph 8 of Annex V of the JCPOA that, effective on JCPOA Implementation Day, Iran would provisionally apply the Additional Protocol to its Safeguards Agreement pending its entry into force, and would fully implement the modified Code 3.1 of the Subsidiary Arrangements to its Safeguards Agreement.

While the Agency continued throughout 2015 to verify the non-diversion of declared nuclear material at the nuclear facilities and locations outside facilities declared by Iran under its Safeguards Agreement, the Agency was not in a position 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.

Syrian Arab Republic (Syria)

In September 2015, the Director General submitted a report to the Board of Governors entitled *Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic* (GOV/2015/51) covering relevant developments since the previous report in September 2014 (GOV/2014/44). 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.[21] In 2015, the Director General renewed his call on Syria to cooperate fully with the Agency in connection with unresolved issues related to the Dair Alzour site and other locations. Syria has yet to respond to these calls.

In 2015, Syria indicated its readiness to receive Agency inspectors, and to provide support for the purpose of performing a physical inventory verification (PIV) at the Miniature Neutron Source Reactor in Damascus. On 29 September 2015, the Agency — after considering the United Nations Department of Safety and Security's assessment of the prevailing security level in Syria and making additional arrangements to ensure the safe transit of the inspectors — successfully carried out the PIV at the reactor.

On the basis of the evaluation of information provided by Syria, the results of the safeguards verification activities and all relevant information available to it, the Agency found no indication of the diversion of declared nuclear material from peaceful activities.

[21] 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.

For 2015, the Agency concluded for Syria that declared nuclear material remained in peaceful activities.

Democratic People's Republic of Korea (DPRK)

In August 2015, 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/2015/49–GC(59)/22), which provided an update of developments since the Director General's report of September 2014.

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.

Since April 2009, the Agency has not implemented any measures under the ad hoc monitoring and verification arrangement agreed between the Agency and the DPRK and foreseen in the Initial Actions agreed at the Six-Party Talks. No verification activities were implemented in the field in 2015, but the Agency continued to monitor the DPRK's nuclear activities by using open source information, including satellite imagery and trade information. Using satellite imagery, the Agency continued to observe signatures during 2015 which were consistent with the operation of the 5 MW(e) reactor at Yongbyon. Renovation or expansion of other buildings was also seen within the Yongbyon site. However, without access to the site, the Agency cannot confirm the operational status of the reactor or the purpose of the other observed activities. The Agency also continued to further consolidate its knowledge of the DPRK's nuclear programme with the objective of maintaining operational readiness to resume safeguards implementation in the DPRK.

The nuclear programme of the DPRK and its ongoing efforts to further develop its nuclear capabilities remain a matter of serious concern. The DPRK's operation of the 5 MW(e) reactor, the ongoing construction at the Yongbyon site, the extension and use of the building housing the reported enrichment facility, and statements about bolstering its nuclear deterrent capability are deeply regrettable. Such actions are clear violations of relevant United Nations Security Council resolutions.

Evolving safeguards implementation

During 2015, the Agency implemented State-level safeguards approaches for 54 States[22] under integrated safeguards. Six of these approaches were updated during the year and the Secretariat is currently in the process of updating the remainder. The Secretariat is planning to develop such approaches for other States in the future. As described in several documents submitted to the Board of Governors, in developing and implementing a State-level safeguards approach, consultations are held with the relevant State and/or regional authority, particularly on the implementation of in-field safeguards measures. Three technical meetings on safeguards implementation were held with Member States in 2015 as part of the Agency's ongoing dialogue with States on safeguards matters.

Enhancing safeguards

In 2015, the Agency continued to ensure consistency and non-discrimination in the implementation of safeguards for States with the same type of safeguards agreements. To generate further efficiencies, it continued to improve associated internal procedures,

[22] And Taiwan, China.

prepared guidance documentation and improved review mechanisms for safeguards implementation. A process based quality management system was implemented, providing tools to document, measure and improve process performance.

Cooperation with State and regional authorities

"the Agency conducted six international, regional and national training courses ... for personnel responsible for overseeing and implementing the State systems of accounting for and control of nuclear material."

In February, the Agency published *Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure*. This is the second of four planned Safeguards Implementation Practices Guides being produced to assist States in building capacity for implementing their safeguards obligations. During the year, the Agency conducted six international, regional and national training courses — in Belarus, Canada, the Republic of Korea, the Republic of Moldova, Turkey and the United States of America — for personnel responsible for overseeing and implementing the State systems of accounting for and control of nuclear material. These training courses involved over 160 participants from more than 50 countries. The Agency also participated in several other training activities organized by Member States on a bilateral basis.

Safeguards equipment and tools

The Agency's instrumentation and monitoring equipment is vital to the implementation of effective safeguards around the world. Throughout 2015, the Agency ensured that this equipment continued to function as required. It also replaced large numbers of old and obsolete pieces of surveillance equipment as part of the ongoing next generation surveillance system replacement campaign.

Among its instrumentation technology foresight activities, which are aimed at identifying and evaluating emerging technologies that could benefit the organization, the Agency held two workshops in 2015, in Vienna, Austria, and Karlsruhe, Germany, which were supported by numerous Member State Support Programmes (MSSPs).

Enhancing Capabilities of the Safeguards Analytical Services (ECAS)

All remaining transition activities needed to move into the new Nuclear Material Laboratory (NML) were finished during 2015. Additional training and administrative space in the NML office was constructed and the planned security upgrades to the main gate facility, the access road and the site perimeter were completed. Procurement, receipt and installation of remaining equipment for the chemical and instrumentation laboratories was completed during the first two quarters. Active testing in the new facility was completed during the period from May to November, and provisional operation commenced in December, following approval by the Agency's internal regulator and acknowledgement by the Austrian Government. With the completion of the ECAS project in December, the Agency is able to conduct safeguards sample analysis in safe, secure and modern facilities for decades to come.

Information technology: MOSAIC

The Agency's safeguards information technology modernization needs are being addressed through the Modernization of Safeguards Information Technology (MOSAIC) project. In 2015, the Agency completed the first phase of the MOSAIC project by transferring data from the mainframe computer to a new platform, re-engineering the associated software applications and decommissioning the mainframe computer. The new safeguards IT working environment provides the Agency with improved information security, enhanced applications and quicker access to data.

Preparing for the future

Research and development is essential to meeting the safeguards needs of the future. During 2015, the Agency continued to implement the *Department of Safeguards Long-Term Research and Development Plan, 2012–2023* with the assistance of MSSPs. To address near term development objectives and to support the implementation of its verification activities, the Agency continued to rely on MSSPs in implementing its *Development and Implementation Support Programme for Nuclear Verification 2014–2015*. At the end of 2015, 20 States[23] and the European Commission had formal support programmes with the Agency.

MANAGEMENT OF TECHNICAL COOPERATION FOR DEVELOPMENT

The Agency's technical cooperation programme supports capacity building and the provision of equipment, and promotes cooperation among Member States through networking, knowledge sharing and partnership facilitation. The programme is delivered through projects in the areas of health and nutrition, food and agriculture, water and the environment, industrial applications and radiation technology, energy planning and nuclear power, nuclear knowledge development and management, and safety and security. Through its Programme of Action for Cancer Therapy (PACT), the Agency enables Member States to introduce, expand and improve their cancer care capacity by integrating radiotherapy into a comprehensive cancer control programme.

Technical cooperation and the global development context

In September 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development (A/RES/70/1) and its 17 SDGs. The Agency's technical cooperation programme is well positioned to contribute actively to Member State efforts to achieve the SDGs in areas such as agriculture, human health and nutrition, clean air and water, affordable and clean energy, industry and innovation, and climate change.

Science and technology are recognized as important enablers of the SDGs. Nuclear science and technology, in particular, have a contribution to make, and the Agency plays an important role in making them available to improve the lives of people. SDG 17 ('Strengthen the means of implementation and revitalize the global partnership for sustainable development'), and specifically its focus on science and technology, is an explicit recognition of this importance. The new SDG framework also emphasizes the importance of data and evidence; here, too, the Agency has an important part to play, for example, helping countries to monitor and manage soil degradation or the impact of nutritional interventions. In addition, Target 3.4 looks to intensify efforts against chronic diseases, including cancer, and aims to save millions of lives by reducing early deaths from non-communicable diseases by one third in the next 15 years. This target is of specific relevance to the various Agency programmes supporting health, including the human health programme, the technical cooperation programme and PACT.

During the 59th regular session of the General Conference, the Agency organized a side event, entitled 'Atoms for Peace and Development: The IAEA and the Post-2015 Development Goals', to discuss the new SDG framework and its relevance to the technical cooperation programme. Participants emphasized the need to ensure a 'people centred' approach to development, stressing the importance of improved education and employment

[23] 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.

opportunities for youth in scientific and technical fields, especially in developing countries. Panellists also highlighted the importance of good quality data and systems for data collection and monitoring as a basis for improved development policies and programmes.

The technical cooperation programme in 2015

"the [technical cooperation] programme supported, inter alia, 3477 expert and lecture assignments, 175 regional and interregional training courses, and 1852 fellowships and scientific visits."

In 2015, safety and security accounted for the highest proportion of actuals — that is, disbursements — through the technical cooperation programme, at 24.8%. This was followed by health and nutrition at 21.7%, and by food and agriculture at 17.2%. By the end of the year, financial implementation of the Technical Cooperation Fund (TCF) stood at 84.8%. Regarding non-financial implementation, the programme supported, inter alia, 3477 expert and lecture assignments, 175 regional and interregional training courses, and 1852 fellowships and scientific visits.

Throughout 2015, the Agency supported Member States in strengthening human capacity for sustainable development, focusing on effectively meeting basic human needs and achieving a tangible socioeconomic impact. Particular attention was paid to improving programme and project quality, building partnerships, supporting strengthened regional cooperation, and enhancing radiation safety and security for the peaceful application of nuclear energy. Considerable efforts were also made to prepare for the 2016–2017 technical cooperation programme cycle, which is guided by the priorities expressed in individual Country Programme Frameworks and national development plans, as well as by regional programme frameworks and priorities.

In Africa, the technical cooperation programme supported 45 Member States (including 26 least developed countries) in the peaceful use of nuclear and isotopic techniques for sustainable development. The support focused on capacity building and training, technology transfer, and expert advice and services, and resulted in improvements in human health through increased access to radiation medicine services, increased capabilities to assess nutrition programmes, and the establishment of capacities to detect emerging zoonotic diseases. Food security was enhanced through increased and more reliable crop production, improved animal health and livestock production, and improved capabilities for livestock disease diagnosis and treatment. Environmental sustainability was enhanced through better investigation, understanding and management of water resources in the continent, and the use of nuclear applications in industry and research was expanded. The technical cooperation programme in Africa also supported the enhancement of legal and regulatory frameworks, strengthened radiation protection, built competence in radiation safety, and strengthened the management of radioactive waste, with particular attention given to used radioactive sources and naturally occurring radioactive material. An increase in interest in nuclear power was also observed in some Member States in the region.

In the Asia and the Pacific region, Agency membership grew with the accession of a number of small island developing States (SIDS) from the Pacific region, which increased demand for technical cooperation support. The Agency provided substantive support to the SIDS in the formulation of their first Country Programme Frameworks, which identify national development priorities where nuclear applications can play a role and potentially contribute to the achievement of the SDGs. In preparation for the 2016–2017 technical cooperation programme cycle, the Agency assisted these new Member States in formulating projects for their first national programmes. The SIDS also received subregional assistance to support the establishment of radiation safety infrastructure and necessary legal frameworks.

Nuclear safety and security continued to be the priority thematic area in the region. Regional projects in radiation protection supported Member States in the development of national radiation safety infrastructure, and two drafting schools on regulations provided a crucial contribution to creating effective national regulatory frameworks for the development of a robust safety culture.

Health and nutrition — in particular addressing malnutrition and non-communicable diseases, including cancer — and food and agriculture were also important areas for Member States in the Asia and the Pacific region. National technical cooperation programmes provided support in the use of isotopic techniques to assess body composition and in the fields of diagnostic medicine, radiotherapy and nuclear medicine. In the area of food and agriculture, projects focused on enhancing food safety and food security. Assistance provided by the Agency helped Member States to enhance crop resilience and productivity, and to establish quality assessment and control mechanisms for enhanced food security.

In Europe, the technical cooperation programme continued to focus on human health; radioactive waste management and environment restoration; nuclear power; and nuclear and radiation safety. Maintaining appropriate levels of safety in all aspects of the peaceful use of nuclear technologies was heavily emphasized, particularly in the regional programme, where projects related to radiation and nuclear safety received around 50% of the total budget for regional cooperation.

Substantial assistance was provided to Member States in the region to strengthen their regulatory infrastructure for safety, including training in the preparation of national regulations in line with the Agency's safety standards, a seminar for drafting regulations for radiation safety and nuclear safety, a postgraduate course on radiation protection and the safety of radiation sources, and a train the trainers course for radiation protection officers.

In the Latin America and the Caribbean region, priority thematic areas for the 2014–2015 technical cooperation cycle were health and nutrition, followed by nuclear safety, water and the environment, and food and agriculture. More than 70% of core funding was allocated to these areas, which will remain priorities for the 2016–2017 cycle.

The *ARCAL Regional Strategic Profile for Latin America and the Caribbean (RSP) 2016–2021* (IAEA-TECDOC-1763) was issued in 2015. This key reference establishes the priority areas for the regional technical cooperation programme.

In addition to traditional capacity building support in various thematic areas in the region, particular attention was paid in 2015 to enhancing governmental and regulatory safety infrastructure and to strengthening regional capacities for radiation emergency preparedness and response. Emphasis was also placed on using nuclear techniques for the early diagnosis and treatment of illnesses such as sarcopenia and cancer, and on applying the sterile insect technique to control important transboundary pests such as the New World screw worm and the Mediterranean fruit fly. Several projects were carried out to promote regional cooperation and to further strengthen existing regional capacities.

Programme of Action for Cancer Therapy (PACT)

In 2015, the Agency expanded its engagement with partners and donors in cancer control to enhance the effectiveness of radiation medicine services in low and middle income countries by further integrating such services into a comprehensive cancer control approach. PACT reinforced the Agency's key role in tackling cancer, representing the organization at high level events and organizing regional meetings and workshops.

Through PACT, the Agency conducted eight impact (integrated missions of PACT) assessments in 2015, and provided expert assistance to the development of several national cancer control plans. The Agency established, strengthened and operationalized partnerships to mobilize financial and human resources for cancer control activities in Member States. Direct assistance was provided to Member States in the development of bankable documents and capacity building in resource mobilization. In addition, plans for the expansion of the Virtual University for Cancer Control and Regional Training Network (VUCCnet) to other sub-Saharan countries were advanced.

Technical cooperation programme management

The technical cooperation programme is delivered in close cooperation with Member States and partners. In 2015, effective and efficient programme management and monitoring resulted in an increased implementation of the TCF. Management, implementation and monitoring processes were further aligned to improve programme delivery based on the principles of results based management, shared responsibility, ownership, relevance and sustainability.

The Agency continued to focus on improving programme quality through quality reviews of project documents for the 2016–2017 technical cooperation programme. These were conducted to support project teams in enhancing the quality of their project designs, and to identify lessons learned and areas for improvement in future technical cooperation cycles. A framework for outcome monitoring of technical cooperation projects was developed and is being piloted with selected projects in the 2016–2017 programme cycle. Training in results based management using the logical framework approach, and in monitoring and evaluation, was conducted for Programme Management Officers, Technical Officers, National Liaison Officers and project counterparts. The overall aim of these initiatives was to prepare and implement projects that would be of high quality, with measurable, attainable and timely objectives, and would better respond to Member State needs and priorities.

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 €78.7 million in 2015, with approximately €66.1 million for the TCF (including assessed programme costs, National Participation Costs[24] (NPCs) and miscellaneous income), €11.9 million in extrabudgetary resources, and about €0.7 million representing in kind contributions.

The rate of attainment for the TCF stood at 94.1% on pledges and at 93.8% on payments at the end of 2015, while payment of NPCs totalled €0.4 million.

Actuals

In 2015, approximately €77.2 million was disbursed to 135 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

Partnership for Continuous Improvement (PCI)

"Identification of priorities and efficiency gains was incorporated into the process for preparing the 2016–2017 Programme and Budget"

In 2015, the Agency continued to streamline business processes and eliminate unnecessary bureaucracy through the Partnership for Continuous Improvement (PCI) initiative. Identification of priorities and efficiency gains was incorporated into the process for preparing the 2016–2017 Programme and Budget to provide greater transparency about the changes being made to use resources more effectively.

[24] 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 the assessed amount for the programme must be paid before contractual arrangements for the projects may be made.

During the year, model contracts for standard procurements were established, substantially reducing the time needed to prepare and finalize them. The process for low value purchasing — covering more than 5000 transactions a year — became fully electronic, reducing the overall effort devoted to such transactions.

Agency-wide Information System for Programme Support (AIPS)

The AIPS Plateau 3 systems for Human Resources and Payroll were introduced, enabling the retirement of two legacy systems. The initial roll-out of the new system caused some disruption early in the year. By the end of 2015, the system had largely been stabilized. The high level design proceeded for the last phase of the AIPS project, covering staff performance management, travel and meetings.

Resource mobilization

In June, the Board of Governors approved the Strategic Guidelines on Partnerships and Resource Mobilization. The guidelines are aimed at assisting the Agency in developing partnerships with traditional and non-traditional donors — including the private sector — to support specific Agency objectives. They outline a comprehensive approach to engaging with these new partners that involves defining the modalities of engagement, monitoring project outcomes and establishing responsibilities.

Nuclear Technology

Nuclear Power

Objective

To assist Member States considering the introduction of nuclear power programmes in planning and building their national nuclear infrastructures. To provide integrated support to Member States with existing nuclear power programmes and to those planning new nuclear build in order to help improve operating performance and safe long term operation through the implementation of good practices and innovative approaches, and lessons learned from the Fukushima Daiichi accident. To provide collaborative frameworks for operators of water cooled reactors to benefit from advances in technology, and for Member States to facilitate effective development of fast reactors and gas cooled reactors and to expand the safe use of non-electric applications.

Launching Nuclear Power Programmes

In 2015, around thirty Member States were actively considering or planning a nuclear power programme (Table 1). The Agency continued to support these embarking countries, mainly through technical cooperation projects, in areas such as establishing the appropriate legal and regulatory framework, strengthening coordination among national institutions, drafting and reviewing human resource development plans, and developing radioactive waste management policies and strategies. Through focused interregional, regional and national workshops, training courses and fellowships, it provided staff of nuclear power development projects, regulatory bodies and technical support organizations substantive training in various infrastructure issues. More than 15 events took place in 2015 focused on increasing Member State awareness and understanding of the 'Milestones' approach and key infrastructure issues such as management, human resource development, the legal and regulatory framework, and funding and financing. Stakeholder involvement continued to be an important area of focus for countries at all stages of nuclear infrastructure development. The Agency facilitated expert missions related to stakeholder involvement in Egypt, Indonesia, Kenya, Saudi Arabia and Viet Nam, as well as workshops in Finland and Japan.

"More than 15 events took place in 2015 focused on increasing Member Stat awareness and understanding of the 'Milestones' approach and key infrastructure issues"

TABLE 1. Number of Member States considering or planning a nuclear power programme, according to their official statements (as of 2015)

First nuclear power plant started construction/under construction	2
First nuclear power plant ordered	1
Decided to introduce nuclear power and started preparing the appropriate infrastructure	7
Active preparation for a possible nuclear power programme with no final decision	7
Considering nuclear power programme	10

To better coordinate assistance to newcomer countries, the Agency consolidated coordination mechanisms such as Country Nuclear Infrastructure Profiles and Integrated Work Plans (IWPs). Taking into account the recommendations of Agency missions and the results of technical cooperation projects, the Country Nuclear Infrastructure Profiles and IWPs of several countries were updated in 2015, in consultation with the Member States concerned.

"The Agency's Integrated Nuclear Infrastructure Review (INIR) missions continued to be in high demand in 2015."

The Agency's Integrated Nuclear Infrastructure Review (INIR) missions continued to be in high demand in 2015. These missions provide Governments and nuclear programme stakeholders with an overall, integrated view of the status of all 19 infrastructure issues of the 'Milestones' approach to introducing a nuclear power programme. INIR recommendations enable Member States to determine which infrastructure areas require further development to meet programme needs and schedule requirements. In 2015, an analysis of past INIR mission recommendations and suggestions was published in *Integrated Nuclear Infrastructure Review (INIR) Missions: The First Six Years* (IAEA-TECDOC-1779). The publication analyses the outcomes of the reviews and derives a picture of the challenges faced by countries hosting INIR missions and the approaches they have developed to address them. Also during the year, steps were taken to finalize the concept for INIR Phase 3 missions, as called for in the IAEA Action Plan on Nuclear Safety and several General Conference resolutions.

In the United Arab Emirates (UAE), construction continued on the country's first nuclear power plant, at Barakah; the first of the plant's four units is expected to be operational by 2017, and the final unit, by 2020. The Agency conducted three safety and security related review missions to the UAE in 2015. Construction continued on both units of Belarus's first nuclear power plant (Fig. 1). Commissioning of the units is planned for 2018 and 2020. The Agency organized several expert missions during the year to advise stakeholders on developing a regulatory framework and ensuring that the required human resources are available. In introducing nuclear power, Turkey is using a build–own–operate contracting approach. In 2015, Turkey's IWP was updated to ensure that Agency assistance and services that support nuclear power infrastructure development are applied effectively, in terms of timing and content, to support the development of the country's nuclear power infrastructure.

FIG. 1. Construction of Units 1 and 2 of the Ostrovets nuclear power plant in Belarus. (Photograph courtesy of the Directorate for Nuclear Power Plant Construction, Belarus.)

Several countries introducing nuclear power advanced in developing their infrastructure in 2015. Bangladesh established the Rooppur Nuclear Power Plant Company to operate the country's first nuclear power plant and started negotiations on state credit and on the general engineering and construction contract. Egypt conducted site evaluation activities and signed an agreement for the construction of a nuclear power plant with four units on the Dabaa site. Jordan signed contracts to perform a water supply study and site supervisory activities, and the Jordan Nuclear Power Company was established in October. Kazakhstan officially requested an INIR mission, scheduled to take place in 2016. An INIR mission concluded that Nigeria had made progress in the development of its nuclear infrastructure and made recommendations for further actions. The Agency and Nigeria developed a four year IWP to ensure that future support is tailored to those recommendations and addresses all nuclear power infrastructure issues in a balanced and prioritized manner. Poland, through its national technical cooperation programme, implemented activities on waste management strategy, developing industrial capabilities and technology transfer, site characterization, and site licensing, as planned in its IWP. It also held a national workshop on financing issues, in Warsaw, to discuss the investment framework. Viet Nam announced that the start of construction of its first nuclear power plant had been rescheduled for 2020–2022, in line with a reassessment of the time needed to build the necessary nuclear power infrastructure.

Ghana, Kenya, Malaysia, Morocco, Saudi Arabia and Sudan are actively preparing to take an informed decision on whether to introduce nuclear power into their energy mix; their focus is on conducting the necessary studies and preparing a comprehensive report. The Agency provided a variety of support during the year, including INIR missions to Kenya and Morocco that recognized the progress made and made recommendations for further actions. The Agency conducted advisory missions to Saudi Arabia and Malaysia supporting the development of self-evaluation reports. Its review of Ghana's draft nuclear power programme policy and road map, and training in the INIR self-evaluation methodology resulted in modifications to the work plan for that country's new technical cooperation project for nuclear power infrastructure development.

The Agency focused in particular on Africa in 2015. At the Third Conference on Energy and Nuclear Power in Africa, held in Kenya in April, representatives of 35 African Member States discussed the need to undertake sustainable energy planning, and many expressed an interest in nuclear power. Following the conference, Niger organized the first meeting of the West African Integrated Nuclear Power Group to study the possibility of creating a regional nuclear power programme. All requests for INIR missions in 2015 came from African countries; namely, Kenya, Morocco and Nigeria. At a Technical Meeting held in Vienna in July, representatives of ten African countries agreed to form the African Network for Enhancing Nuclear Power Programme Development (ANENP). During the 59th regular session of the Agency's General Conference, participants in a side event entitled 'Africa's Energy Needs and the Potential Role of Nuclear Power' highlighted the Agency's important role as a forum for newcomer countries and countries operating nuclear power plants to share knowledge and experience.

"The Agency published an updated version of Milestones in the Development of a National Infrastructure for Nuclear Power"

The Agency published an updated version of *Milestones in the Development of a National Infrastructure for Nuclear Power* (IAEA Nuclear Energy Series No. NG-G-3.1 (Rev. 1)) in July. The new version takes into account feedback on implementation of the 'Milestones' approach in Member States and is expected to enhance and expand Agency guidance for embarking countries.

Operating Nuclear Power Plants

At the Fifth Nuclear Operating Organization Cooperation Forum, held during the 59th regular session of the General Conference in September, industry executives from

Canada, Finland, Japan and the Republic of Korea, and from the Electric Power Research Institute, World Association of Nuclear Operators and NUGENIA (Nuclear Generation II and III Association) discussed the top challenges for the nuclear power industry in the next decade. The more than 75 participants agreed that new strategies and tools, and organizational resilience were needed to address challenges resulting from changing nuclear, environmental and financial policies, coupled with evolving energy markets and portfolios that include renewable sources.

New Publication on Plant Life Management Models

When nuclear power plants reach the end of their nominal design life, they undergo a special safety review and an ageing assessment of their essential structures, systems and components before their licence to operate is validated or renewed for terms beyond the original service period. In 2015, the Agency issued *Plant Life Management Models for Long Term Operation of Nuclear Power Plants* (IAEA Nuclear Energy Series No. NP-T-3.18), which highlights the licensing practices of several Member States regarding long term operation. The publication supports nuclear power plant owners and operators planning an extension of plant operation beyond design life, and provides information on the necessary mechanisms for implementing ageing management in plants constructed with long term operation in mind.

"The Agency developed two new e-learning modules based on the 'Milestones' approach, bringing to 13 the number of modules available on the Agency's web site"

Milestones e-Learning Modules

The Agency developed two new e-learning modules based on the 'Milestones' approach, bringing to 13 the number of modules available on the Agency's web site (Fig. 2). Over 40 participants from 28 Member States presented their feedback on using the modules at a Technical Meeting on education and training using e-learning tools, held in Vienna in March. Participants affirmed the usefulness and appropriateness of the content, and made recommendations for improvements.

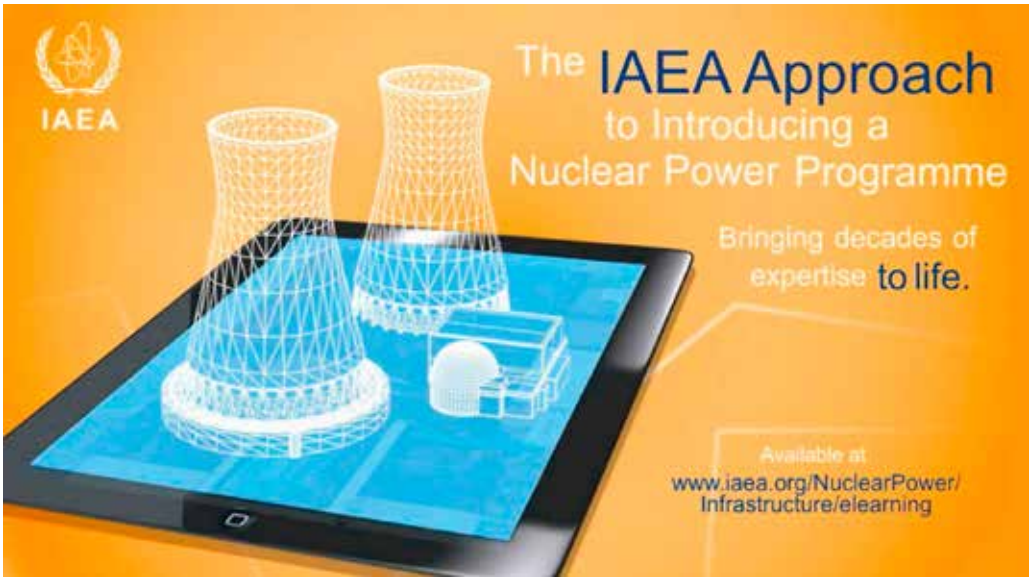

FIG. 2. The Agency's 'Milestones' approach to introducing a nuclear power programme is featured in 13 interactive e-learning modules available on the Agency's web site.

Capacity Building and Management Support

Throughout the year, the Agency held a number of Technical Meetings and workshops to provide training in areas such as communication, management systems, the nuclear supply chain and industrial safety. Recognizing that responsible, sustainable nuclear power programmes require a commitment to open and transparent communication, the Agency organized a Technical Meeting on best practices in media and public communication for nuclear power programmes. Hosted by Fukui Prefecture, Japan, in October, the meeting was attended by more than 50 participants from 23 countries, both newcomer countries and countries with established nuclear power programmes. The participants focused on sharing experience, good practices and lessons learned, and on exploring how to enhance competencies and better respond to stakeholders' needs.

The joint IAEA–FORATOM Management System Workshop, held in June in Gloucester, United Kingdom, focused on leadership and management for safety in a challenging environment. Over 100 participants from 28 Member States discussed how safety can be enhanced through leadership and management, thinking beyond the rules and managing risks. They also shared practical examples of managing safety.

Member States showed considerable interest in topics related to the supply chain in 2015. Three workshops on bid evaluation and contracting for nuclear power plants, held through the technical cooperation programme, assisted Bangladesh, Malaysia and Viet Nam in establishing adequate processes for procurement.

A Technical Meeting on industrial safety at nuclear facilities, held in Fuqing, China, in November, enabled 22 participants from 11 Member States to share their experience and practices in this area, and to provide feedback on a draft Agency guidance document on the subject. Meeting participants noted that identifying and tracking near miss events and all instances of time lost due to accidents and injuries remained a challenge in many Member States.

"a Technical Meeting on best practices in media and public communication for nuclear power programmes….was attended by more than 50 participants from 23 countries."

Support for Accident Monitoring Systems for Nuclear Power Plants

In February, the Agency issued *Accident Monitoring Systems for Nuclear Power Plants* (IAEA Nuclear Energy Series No. NP-T-3.16), covering all relevant aspects of accident monitoring in nuclear power plants. The report addresses issues such as accident management and accident monitoring strategies; selection of plant parameters for monitoring plant status; and establishment of performance, design, qualification, display and quality assurance criteria for designated instrumentation.

Development and Implementation of a Process Based Management System

Implementing a process based management system can be challenging for organizations accustomed to traditional, non-integrated, non–process based management systems. In this regard, in 2015 the Agency published *Development and Implementation of a Process Based Management System* (IAEA Nuclear Energy Series No. NG-T-1.3). The publication provides practical guidance to nuclear organizations planning to implement a management system in compliance with the requirements established in *The Management System for Facilities and Activities* (IAEA Safety Standards Series No. GS-R-3), as well as to nuclear organizations in embarking countries.

Nuclear Power Technology Development

In February, in the framework of the IAEA Action Plan on Nuclear Safety, the Agency hosted an International Experts Meeting on Strengthening Research and Development Effectiveness in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant. Over 150 experts from 35 Member States and 5 international organizations discussed post-Fukushima research and development strategies, measures to protect nuclear power plants against external and internal events, technologies to prevent and mitigate severe accidents, severe accident analysis, emergency preparedness and response, and post-accident recovery. The Agency followed up the meeting by holding a Technical Meeting on Severe Accident Mitigation through Improvements in Filtered Containment Venting for Water Cooled Reactors, in August, and a Training Meeting on Post-Fukushima Research and Development Strategies and Priorities, in December. During 2015, the Agency developed a training toolkit designed to support capacity building in Member States that are embarking on a severe accident management programme.

A workshop held in Vienna in September, with 34 participants from 23 Member States, was aimed at assisting embarking countries in evaluating available nuclear power technologies against their own country specific environments, site requirements and energy needs. Courses on understanding the physics and technology of advanced reactors using PC based simulators were held in Chile, Jordan, the Republic of Korea and the United States of America, which together drew 157 participants from over 20 Member States. Also in 2015, the Agency launched a new activity aimed at studying the integration of nuclear power with renewables and smart grids. A booklet entitled *Advanced Large Water Cooled Reactors*, based on the Agency's Advanced Reactors Information System (ARIS) database, was published in September.

"Courses on understanding the physics and technology of advanced reactors using PC based simulators…. drew 157 participants from over 20 Member States."

In response to growing interest in the development of small modular reactors for both electricity generation and non-electric applications, the Agency held a side event at the General Conference in September and a Technical Meeting in Vienna in October highlighting design, safety, regulation and operational aspects of small modular reactors to promote sustainable nuclear power technology for near term deployment. At a Technical Meeting on the Economic Analysis of High Temperature Gas Cooled Reactors and Small and Medium Sized Reactors, held in Vienna in August, 17 participants from 14 Member States and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA) identified the need for technology developers and economists to cooperate closely in order to ensure more accurate economic analyses of advanced small reactor designs.

In the area of fast reactors, the Agency's activities in 2015 were focused largely on safety related issues. The Agency continued its work with the Generation IV International Forum on developing safety design criteria for and guidelines on innovative sodium cooled fast reactors. A Technical Meeting on Passive Shutdown Systems for Liquid Metal-cooled Fast Reactors (LMFR), held in Vienna in October, was attended by 20 experts from 12 Member States. In May, the Agency hosted the 48th annual Meeting of the Technical Working Group on Fast Reactors, in Obninsk, Russian Federation. Discussions among the 22 participants from 17 Member States and the European Commission included proposals for Technical Meetings, coordinated research projects (CRPs) and studies to be implemented in forthcoming programme and budget cycles. The new Fast Reactor Knowledge Preservation Portal went live at the end of the year, enabling Member States with a fast reactor programme to share both publicly available and protected data and documentation on fast neutron systems, and to retrieve information on recent and ongoing CRPs and other studies. In 2015, the Agency issued two publications on fast reactors: *Fast Reactors and Related Fuel Cycles: Safe Technologies and Sustainable Scenarios* and *Status of Accelerator Driven Systems Research and Technology Development* (IAEA-TECDOC-1766).

The Agency's activities in the area of high temperature (gas cooled) reactors in 2015 supported near term deployment through evaluations of technology readiness, safety requirements, economics and sustainability aspects. At the Technical Meeting on Re-evaluation of Maximum Operating Temperatures and Accident Conditions for High Temperature Reactor Fuel and Structural Materials, held at the Agency's Headquarters in January, participants concluded that reactor deployment with coolant outlet temperatures of up to 850°C is already possible. At the June meeting of the CRP on Modular High Temperature Gas Cooled Reactor Safety Design, held in Vienna, participants adopted two approaches to establishing safety design criteria that take the unique design and safety characteristics of such reactors into account. The Training Course on High Temperature Gas Cooled Reactor Technology hosted by Indonesia in October attracted more than 40 participants from 17 Member States. The course addressed the technological features of modular high temperature gas cooled reactor (HTGR) designs, the impact of their inherent safety characteristics and the safety assessment of advanced HTGR concepts. The Agency launched a new initiative to preserve the high temperature reactor knowledge developed over many decades at the Jülich Research Centre as part of a larger knowledge preservation effort, similar to the one already in place for fast reactors.

In view of the renewed interest in cogeneration of electricity and process heat for non-electric applications using nuclear energy, the Agency organized several activities relating to seawater desalination, hydrogen production and industrial applications. It also continued to upgrade the related tools and toolkits developed to help decision makers evaluate the feasibility of such applications. In 2015, the Agency published *New Technologies for Seawater Desalination Using Nuclear Energy* (IAEA-TECDOC-1753) and organized three major Technical Meetings on the topic, in Vienna, Istanbul and Mumbai, attracting 41 participants from 18 Member States and the OECD/NEA. Also during the year, the Agency organized a consultants meeting to draft a generic guidance report on nuclear cogeneration, held in Vienna. The report will define all aspects of a study of the technical and economic feasibility of using nuclear energy for seawater desalination, both alone and for cogeneration options.

"the Agency organized several activities relating to seawater desalination, hydrogen production and industrial applications."

Enhancing Global Nuclear Energy Sustainability through Innovation

The International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) aims at ensuring that nuclear energy is available to contribute to meeting the energy needs of the twenty-first century in a sustainable manner. With Thailand joining in 2015, INPRO's membership grew to 41. During the year, Nuclear Energy System Assessments were under way in Indonesia, Romania and Ukraine to support strategic, long range nuclear energy planning. A preparatory meeting was held in the Russian Federation to begin limited scope assessments of specific sodium cooled fast reactor designs using the INPRO methodology.

Two joint consultancies were held in Vienna in May and in September–October with sodium cooled fast reactor design authorities from China, India and the Russian Federation, covering sustainability assessments of reactor safety and economics using the INPRO methodology. A Training Course on Nuclear Energy System Modelling and Assessment Using the INPRO Methodology, held in November in Kuala Lumpur, Malaysia, attracted 29 participants from nine Member States. Three Technical Meetings held in Vienna in November and December, with 36 participants from 16 Member States and the OECD/NEA, focused on INPRO collaborative projects on nuclear fuel and fuel cycle analysis of future nuclear energy systems, key indicators for innovative nuclear energy systems, and waste from innovative types of reactors and fuel cycles. Interactive WebEx based lectures on modelling of nuclear energy systems and assessments using the INPRO methodology were delivered to several universities and research institutions in Member States.

The Tenth INPRO Dialogue Forum, held in Vienna in May, addressed cooperative approaches to the back end of the nuclear fuel cycle and included discussions of drivers of these approaches as well as legal, institutional and financial impediments. The Eleventh INPRO Dialogue Forum, held in Vienna in October, considered the development of road maps for a transition to globally sustainable nuclear energy systems. These two Forums attracted 87 experts from 31 Member States.

Nuclear Fuel Cycle and Materials Technologies

Objective

To advance the development and implementation of an increasingly safe, reliable, economically efficient, proliferation resistant and environmentally sustainable nuclear fuel cycle, providing the maximum benefit to Member States. To implement relevant actions under the [IAEA] Action Plan [on Nuclear Safety], including the collection of data on damaged fuel and storage facilities at the Fukushima Daiichi nuclear power plant and the strengthening of information exchange on nuclear fuel under severe conditions.

Uranium Resources and Production

Sustainable uranium production is critical for sustainable development of nuclear power. In 2015, the Agency focused on efforts to help Member States increase sustainable uranium production and to use uranium resources more efficiently. In this connection, it organized the Leadership Academy on Sustainable Uranium and Critical Materials Production from Phosphates and Other Sources, held in August in Nanchang, China (Fig. 1). Over 50 experts from 25 counties discussed the challenges faced by the mining industry, and by the uranium industry in particular. Participants also discussed the project design, management and implementation skills and competencies that are critical for projects to extract uranium from phosphates and other unconventional sources.

FIG. 1. The Leadership Academy on Sustainable Uranium and Critical Materials Production from Phosphates and Other Sources was hosted by the East China University of Technology, in Nanchang, China. (Photograph courtesy of ECUT.)

In November, at the 52nd Meeting of the Joint OECD/NEA–IAEA Uranium Group, held in Vienna, 48 delegates from 30 countries discussed the latest estimates of worldwide uranium supply and demand. The discussion results will serve as input to the forthcoming *Uranium 2016: Resources, Production and Demand*, also referred to as the 'Red Book'. At a Technical Meeting on Spatial and Quantitative Uranium Resource Assessments held in November in Vienna, 35 delegates from 21 countries discussed how methodologies for estimating undiscovered resources developed for other minerals could be applied to uranium resources.

A Technical Meeting on Public and Community Acceptability of Uranium Mining and Milling, held in December in Vienna, attracted 34 participants from 18 countries. The meeting highlighted the importance of assuring the public that uranium is being mined responsibly, as a lack of public acceptance might result in government intervention, leading to delay, hindering or even closing of mining operations.

As part of a technical cooperation project entitled 'Supporting Sustainable Development of Uranium Resources', the Agency continued to assist 30 countries in Africa through activities designed to address common priorities concerning uranium exploration, mining, processing and regulation. Over 150 regional and international experts participated in four workshops and training courses, held in Egypt, Namibia, Uganda and the United Republic of Tanzania. The focus was on aspects of geology, technology and management that can accelerate the progression of uranium projects from initial discovery to commercial production. The Agency also provided assistance to francophone African Member States through a project funded by the Peaceful Uses Initiative aimed at supporting sustainable uranium mining in less prepared areas. As part of the project, two workshops on uranium mining and processing, including health, safety and environmental aspects, were held in Vienna, in April and November, attended by 25 experts from 10 countries.

"the Agency continued to assist 30 countries in Africa through activities designed to address common priorities concerning uranium exploration, mining, processing and regulation."

The Agency launched a new coordinated research project (CRP), entitled 'Uranium/Thorium Fuelled High Temperature Gas Cooled Reactor Applications for Energy Neutral and Sustainable Comprehensive Extraction and Mineral Product Development Processes', with participants from 15 Member States. The project will explore innovative technologies for applying thermal and chemical processes to extract valuable materials, including uranium, from a variety of ore types. These techniques provide the added advantage of producing smaller volumes of solid residues rather than the usual wet tailings and mud, which are difficult to manage. The Agency also started a new CRP on geochemical and mineralogical characterization of uranium and thorium deposits. The project, which involves the participation of 13 Member States, will examine new analytical techniques available for understanding uranium deposit models and improving exploration, production and environmental management methods.

Nuclear Power Reactor Fuel

During the year, the Agency continued its work on the development, design, manufacture, use and performance of fuel for all types of nuclear power reactors. As called for in the IAEA Action Plan on Nuclear Safety, particular emphasis was given to the development of fuels with increased accident tolerance and to the analysis of fuel behaviour in accident conditions.

In April, the Agency published *Quality and Reliability Aspects in Nuclear Power Reactor Fuel Engineering* (IAEA Nuclear Energy Series No. NF-G-2.1). The publication provides high level guidance on achieving the criteria specifically related to the design, manufacture and use of nuclear fuel established in *Nuclear Fuel Cycle Objectives* (IAEA Nuclear Energy Series No. NF-O).

The Agency also published *Modelling of Water Cooled Fuel Including Design Basis and Severe Accidents* (IAEA-TECDOC-CD-1775), the proceedings of a Technical Meeting held in 2013

in Chengdu, China, that focused on lessons learned from the accident at the Fukushima Daiichi nuclear power plant. And as part of the ongoing CRP entitled 'Near Term and Promising Long Term Options for Deployment of Thorium Based Nuclear Energy', initiated in 2012, the Agency published *Performance Analysis Review of Thorium TRISO Coated Particles during Manufacture, Irradiation and Accident Condition Heating Tests* (IAEA-TECDOC-1761).

A CRP entitled 'Evaluation of Conditions for Hydrogen-Induced Degradation of Zirconium Alloys during Fuel Operation and Storage', launched in 2011 with 15 partners from 14 Member States, was completed in 2015. The project produced consistent sets of data on the initial stages of crack development that define conditions when fuel integrity can be lost.

Management of Spent Fuel from Nuclear Power Reactors

In June, the Agency hosted the International Conference on Management of Spent Fuel from Nuclear Power Reactors — An Integrated Approach to the Back End of the Fuel Cycle. Held at the Agency's Headquarters in Vienna, the conference attracted over 200 participants from 41 Member States. The participants agreed on the need for an integrated approach to spent fuel management, especially in the areas of processing, storage, transport and disposal. The need to adopt a holistic view for the management of spent fuel was also identified. The Director General highlighted the importance for countries embarking on a nuclear power programme to develop 'cradle to grave' plans for both spent fuel and radioactive waste, and encouraged those with existing nuclear power programmes to share their experience with newcomer countries. During the year, the proceedings of the previous conference, held in 2010, were issued in a book entitled *Management of Spent Fuel from Nuclear Power Reactors*.

In November, the Agency hosted a workshop for countries developing new nuclear power programmes aimed at promoting such cradle to grave practices. Held at the Agency's Headquarters in Vienna, the workshop's seven participants from six Member States engaged in detailed discussions on the consequences of different options for spent fuel and radioactive waste management.

"in 2015 the Agency intensified its efforts to develop e-learning materials on spent fuel management."

An integrated approach to spent nuclear fuel management ensures that interdependencies between the different steps to disposal are taken into account from safety, technical and organizational standpoints. To support such an approach in the back end of the fuel cycle, the Agency published *Potential Interface Issues in Spent Fuel Management* (IAEA-TECDOC-1774) in 2015.

In June, the Agency hosted a Technical Meeting on managing plutonium in the absence of a fast breeder reactor or alternative fuel cycle programme, with 13 participants from six Member States and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development. The meeting participants reviewed the challenges related to the back end of the fast reactor fuel cycle and discussed emerging technologies for reprocessing used fast reactor fuels.

Having — and maintaining — the right scientific, technical and engineering skills is crucial to ensuring ongoing safety and to delivering a comprehensive and safe fuel cycle. To support knowledge and skills retention, in 2015 the Agency intensified its efforts to develop e-learning materials on spent fuel management. Member States and users of the spent fuel management network will be able to access the materials through the Cyber Learning Platform for Nuclear Education and Training (CLP4NET) on the Agency's web site.

Capacity Building and Nuclear Knowledge Maintenance for Sustainable Energy Development

Objective

To strengthen Member State capacities to use energy and nuclear power planning to elaborate sustainable energy strategies and conduct studies for energy system and electricity supply options, energy investment planning and energy environment policy formulation. To build Member State capacities to manage nuclear knowledge and provide knowledge management services and assistance. To procure and provide printed and electronic information in the area of nuclear science and technology to the IAEA Secretariat and Member States.

Energy Modelling, Databanks and Capacity Building

The Agency continued to support Member States in building capacity for energy system planning and for assessing the potential contribution of nuclear power to meeting energy needs. During the year, through a mix of e-learning courses and face to face training, the Agency trained approximately 390 energy analysts and planners from 95 Member States in using its analytical tools for conducting national and regional studies of future energy strategies and the potential role of nuclear power. Modelling focused in particular on sustainable electricity options in the power pools of western and southern Africa. Efforts to enhance the tools continued during the year, with the development of improved versions of MAED (Model for Analysis of Energy Demand) and ESST (Energy Scenario Simulation Tool). The Agency also developed a French version of the e-learning materials for SIMPACTS (Simplified Approach for Estimating Impacts of Electricity Generation). These tools are now being used in research and planning institutions in 130 countries and have been acquired by 20 international and regional organizations for use in their energy projects in developing countries.

Energy–Economy–Environment (3E) Analysis

In advance of the 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21), the Agency published *Climate Change and Nuclear Power 2015*. Significantly updating its predecessor, the 2015 report emphasizes the importance of nuclear energy in reducing greenhouse gas emissions from the electricity sector and identifies nuclear power as a low carbon technology, along with wind and hydropower. The report concludes that nuclear energy is necessary to help meet global energy needs while reducing greenhouse gas emissions to a level consistent with keeping the global average temperature within 2°C above pre-industrial levels. A French version of *Climate Change and Nuclear Power* was also published during the year.

The Agency continued its involvement with the Working Group on Climate Change of the United Nations High-Level Committee on Programmes. At high level side events and within the United Nations exhibit booth at COP21, the Agency presented the sustainability benefits of nuclear power, including its potential contributions to sustainable development (Fig. 1). It also showcased nuclear energy as a clean, reliable, affordable energy source and a key technology for climate change mitigation.

In November, the Agency published *Indicators for Nuclear Power Development* (IAEA Nuclear Energy Series No. NG-T-4.5). The book provides stakeholders with a set of indicators to help them assess the broader context of establishing or expanding a nuclear power programme with regard to the macro-, techno- and socioeconomic aspects of nuclear power, as well as the energy and environmental dimensions.

During the year, the Agency conducted coordinated research projects in the areas of financial modelling for new nuclear power plants, energy infrastructure vulnerability to climate change, assessment of national and regional economic and social effects of nuclear programmes, and the CLEW (climate, land, energy and water) framework for integrated assessment of resource systems. A total of 29 Member States, including operating countries, nuclear newcomers and non-nuclear countries, took part in the projects, performing country case studies.

"the Agency published Indicators for Nuclear Power Development.... [helping stakeholders to] assess the broader context of establishing or expanding a nuclear power programme."

FIG. 1. At side events (left) and within the United Nations exhibit booth (right), the Agency provided COP21 delegates with information on nuclear applications and on nuclear power as a low carbon energy source.

Nuclear Knowledge Management

With strong support from the General Conference, and with extrabudgetary funding from Japan, over the past three years the Agency has been working to improve the availability and accessibility of master's level courses for nuclear sector managers through the establishment of the International Nuclear Management Academy (INMA). Within the collaborative framework for the INMA, four assist missions were undertaken in 2015 to the participating universities: North-West University and the University of the Witwatersrand in South Africa; Tsinghua University in China; and the University of Manchester in the United Kingdom.

The Agency provides an important service to its Member States through its Knowledge Management Assist Visits. In 2015, it carried out visits to the Smolenskaya nuclear power plant in the Russian Federation in February, and to the Nuclear Power Production and Development Company of the Islamic Republic of Iran and the KSU training centre at the Ringhals nuclear power plant in Sweden in November. The visits focused on improving

understanding of the strategic importance, shared responsibilities and specific challenges of sustaining the nuclear knowledge base needed for high levels of safety, as well as on sharing experience.

The Agency held three Nuclear Energy Management Schools during the year: the second Joint United Arab Emirates–IAEA Nuclear Energy Management School was held at Khalifa University in Abu Dhabi in May; the third annual IAEA–Japan Nuclear Energy Management School was held at the University of Tokyo in June; and the sixth annual Joint ICTP–IAEA Nuclear Energy Management School was held at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy, in November. In addition, the 11th annual ICTP–IAEA Nuclear Knowledge Management School was conducted in Trieste in September. A total of 167 participants from over 30 Member States graduated from these schools during the year.

The Agency continued to support the activities of, and collaboration among, the regional nuclear education networks that it helped to establish, namely the AFRA Network for Education in Science and Technology (AFRA-NEST), the Asian Network for Education in Nuclear Technology (ANENT) and the Latin American Network for Education in Nuclear Technology (LANENT). The Agency facilitated the establishment of a fifth regional network, the Regional Network for Education and Training in Nuclear Technology (STAR-NET), with 12 universities from six countries in eastern Europe and central Asia signing an agreement at a consultancy meeting in September in Vienna. Close collaboration with the European Nuclear Education Network (ENEN) continued during the year.

"over 7000 users from more than 70 countries used CLP4NET in 2015."

The Cyber Learning Platform for Nuclear Education and Training (CLP4NET) continued to be recognized by the regional nuclear education networks as an effective learning management system platform to support capacity building and knowledge transfer in the nuclear sector. CLP4NET was used throughout the Agency to support the delivery of on-line e-learning materials to Member States. More than 50 separate courses and training modules have already been deployed on the platform, and over 7000 users from more than 70 countries used CLP4NET in 2015.

Collection and Dissemination of Nuclear Information

In 2015, Burundi joined the International Nuclear Information System (INIS), the Agency's largest document repository, operated in collaboration with 130 Member States and 24 international organizations. Of the almost 3.9 million records within INIS, over half a million full texts are not readily available through commercial channels. The Agency added over 136 000 metadata records and 8000 full texts to the INIS Repository during the year, making it the highest annual input in the history of INIS. The INIS Repository had over 2.3 million page views and 1.9 million document downloads in 2015.

In cooperation with the National INIS Centre of Japan within the Japan Atomic Energy Agency, the INIS Secretariat began incorporating the Fukushima Nuclear Accident Archive records into its collection in 2015. During the year, INIS developed an application for harvesting bibliographic metadata from open access archives, publishers and other information providers. The Agency also used the Open Nuclear Information eXchange System (ONIXS) to harvest thousands of records from PubMed Central and the Food and Agriculture Organization of the United Nations.

Participants from 22 countries attended an INIS training seminar, held in October in Vienna, aimed at building capacity and improving many aspects of national INIS operational capabilities. The INIS Thesaurus, available in eight languages with almost 31 000 well defined descriptors, continued to serve the international community; the Thesaurus was maintained through intensive collaboration with Member States. To mark the forty-fifth anniversary of INIS, the Agency published a special edition of the *Nuclear Information Newsletter*.

The IAEA Library continued to ensure that information resources and services remained current, cost effective and easily accessible. The number of electronic journals available through the Library increased from 28 000 in 2014 to over 50 000 in 2015. More than 14 000 people visited the Library in 2015, and 20 000 documents were loaned out. The number of electronic resources entered in the collection rose by 38% compared with 2014.

Responding to customer requests for tailored packaging of nuclear information products and services, the number of personalized user profiles grew to 2202. The Agency offered over 50 training sessions covering general aspects of the Library for newcomers as well as personalized sessions answering the specific needs of Agency staff members.

The Agency's mandate includes fostering information exchange. In this regard, membership in the International Nuclear Library Network, coordinated by the IAEA Library, grew to 55 partners in 2015. The three new members are the Research Centre for Energy, Environment and Technology (CIEMAT) in Spain, the Belgian Nuclear Research Centre (SCK•CEN) and the library and information centre of the Nuclear Research Center NEGEV-NRCN in Israel.

"The number of electronic journals available through the Library increased from 28 000 in 2014 to over 50 000 in 2015."

Nuclear Science

Objective

To increase Member State capabilities in the development and application of nuclear science as a tool for their technological and economic development. To assist Member States in the management and effective utilization of research reactors.

Nuclear Data

Throughout 2015, the Agency continued to coordinate the International Network of Nuclear Reaction Data Centres (NRDC) and the International Network of Nuclear Structure and Decay Data Evaluators (NSDD) — the two networks that link regional data centres worldwide. In April, it held a Technical Meeting of the NRDC in Vienna, with 16 participants from 10 Member States. During the meeting, two new data centres, in Romania and the United States of America, joined the network, bringing the total to 13 centres in nine countries. During the year, the Agency added over 500 experiments to the Experimental Nuclear Reaction Data (EXFOR) database, the NRDC's main product, which now covers more than 21 000 experiments.

In April, the Agency held a Technical Meeting of the NSDD at its Headquarters in Vienna. The 36 meeting participants from 15 Member States assessed the current status of the Evaluated Nuclear Structure Data File (ENSDF) and drew a road map for updating and maintaining existing nuclear structure codes and developing new ones. The Agency also conducted two training workshops jointly with the Abdus Salam International Centre for Theoretical Physics (ICTP) for 64 participants from 21 Member States. The first workshop, in March, addressed modern plasma spectroscopy methods; the second, held in April, looked at nuclear data for neutron dosimetry and analytical methods for research reactors.

Research Reactors

Utilization and application of research reactors

In November, 314 experts from 56 Member States participated in the International Conference on Research Reactors: Safe Management and Effective Utilization. Held at the Agency's Headquarters in Vienna, the conference provided a forum for the exchange of information and experience on research reactor operation and maintenance, utilization, safety and security, decommissioning, and fuel management, as well as new research reactor projects.

In the first half of 2015, the Agency held an interlaboratory comparison exercise on neutron activation analysis involving 35 facilities. In a follow-up workshop, held in August

in Delft, Netherlands, 32 participants from 28 Member States shared good practices and the lessons learned from the exercise.

To explore and quantify national capabilities to produce molybdenum-99 (^{99}Mo) through neutron capture pathway on natural or ^{98}Mo enriched targets, the Agency carried out a round robin exercise involving teams at 18 research reactors (Fig. 1). Each team performed a set of experiments, and the results were then discussed and analysed during a follow-up workshop, held in December in Vienna, with 17 participants from 17 Member States.

FIG. 1. Metallic (left) and oxide (right) samples of natural molybdenum used in the molybdenum-99 round robin exercise.

The Agency worked with the Korea Atomic Energy Research Institute to organize the 2015 International HANARO Symposium, held jointly with the IAEA Regional Workshop on Research Reactor Coalitions: Enhanced Networking in the Asia-Pacific Region. The symposium, held in May in Daejeon, Republic of Korea, was attended by more than 200 participants from 30 Member States. The participants discussed issues such as research reactor utilization, operation and maintenance, safety, and ageing management.

Through two six week, hands-on training courses on research reactors, organized in cooperation with the Eastern European Research Reactor Initiative (EERRI), the Agency provided training to 18 participants from 8 Member States. The courses were hosted by facilities in Austria, the Czech Republic, Hungary and Slovenia. A total of 86 students from around the world have benefited from the training programme since its inception in 2009.

From 28 September to 2 October, the Agency held the second Training Workshop on Advanced Use of Neutron Imaging for Research and Applications, in Villigen, Switzerland. The workshop was attended by 24 participants and 8 lecturers from 20 Member States and featured hands-on training on neutron and X ray imaging instruments at the Paul Scherrer Institute.

During the year, the Agency issued three publications presenting the outcomes of coordinated research projects (CRPs) on research reactors: *Research Reactor Benchmarking Database: Facility Specification and Experimental Data* (Technical Reports Series No. 480), *Feasibility of Producing Molybdenum-99 on a Small Scale Using Fission of Low Enriched Uranium or Neutron Activation of Natural Molybdenum* (Technical Reports Series No. 478) and *Use of Neutron Beams for Materials Research Relevant to the Nuclear Energy Sector* (IAEA-TECDOC-1773).

New research reactor projects, infrastructure development and capacity building

To assist Member States in planning for a new research reactor within the framework of the Agency's 'Milestones' approach, the Agency held a Training Workshop on Assessment

of the National Nuclear Infrastructure to Support a New Research Reactor Project. The workshop, held in May, was attended by 27 participants from 22 Member States. Also in May, a Training Workshop on Milestones and Infrastructure for New Research Reactor Projects was held in Cairo, Egypt. The workshop was organized in cooperation with the Arab Network of Nuclear Regulators (ANNuR) and the Forum of Nuclear Regulatory Bodies in Africa (FNRBA), and attended by 18 participants from 11 Member States.

In January and March, the Agency conducted two expert missions, to the Sudan and the Plurinational State of Bolivia, respectively. The missions were aimed at assisting those countries in planning the construction of their first research reactors.

To help Member States build capacity, the Agency co-organized the first meetings of the Internet Reactor Laboratory (IRL) projects in Latin America and Europe. The meetings were held in Bariloche, Argentina, in September, in cooperation with the National Atomic Energy Commission (CNEA) of Argentina; and in Saclay, France, in October, in cooperation with the Atomic Energy Commission (CEA). A hands-on training course on research reactors was organized by reactor facilities at Indonesia's National Nuclear Energy Agency (BATAN) and the Malaysian Nuclear Agency. The Agency supported the attendance of 11 participants from seven Member States. Both activities were implemented in the framework of projects funded by the Peaceful Uses Initiative.

During the 59th regular session of the General Conference, the Director General designated the French CEA (Research Centres of Saclay and Cadarache) as the first IAEA designated International Centre based on Research Reactor (ICERR). This designation recognizes an organization's ability to serve as a reference point at the international level in providing research and capacity building services to other organizations and Member States.

Research reactor operation and maintenance

During the year, the Agency organized training and meetings on research reactor operation and maintenance. In April, a meeting on the implications of the Fukushima Daiichi accident for research reactors was held in Tel Aviv, Israel, attended by 29 participants from 10 Member States. At a Training Workshop on Non-Destructive Examination and In-Service Inspection of Research Reactors, held at the Agency's Headquarters in October, 16 participants from 12 Member States received practical training at the TRIGA research reactor at the Institute of Atomic and Subatomic Physics of Vienna Technical University.

In cooperation with the National Organization of Test, Research, and Training Reactors (TRTR) of the United States of America, the Agency organized the joint 2015 TRTR Conference–Technical Meeting on Research Reactor Ageing Management, Refurbishment and Modernization. Held in October in Brewster, MA, the conference attracted 160 participants from 20 countries. Approximately 50 presentations were delivered, covering research reactor operation and maintenance, utilization, research, regulatory aspects and training activities.

Research reactor fuel cycle

Three new CRPs addressing the research reactor fuel cycle were initiated in 2015. In April, work began on a new CRP entitled 'Benchmarks of Computational Tools against Experimental Data on Fuel Burnup and Material Activation for Utilization, Operation and Safety Analysis of Research Reactors', with the participation of 12 Member States. In June, a CRP entitled 'Options and Technologies for Managing the Back End of the Research Reactor Fuel Cycle' was started, with 15 participating Member States. And in December, a new CRP on accelerator driven system (ADS) applications and the use of low enriched uranium (LEU) in ADSs was initiated, with participants from 15 Member States.

The Agency continued its efforts to support medical isotope production without the use of high enriched uranium (HEU). In October, it hosted a Technical Meeting on the Global

Capabilities for the Production and Manufacture of Molybdenum-99 Targets, attended by 31 participants from 15 Member States and the European Union. It also participated in the 2015 ^{99}Mo Topical Meeting, held by the National Nuclear Security Administration of the United States of America; the Fifth Workshop on Signatures of Medical and Industrial Isotope Production (WOSMIP); and the OECD Nuclear Energy Agency High-level Group on the Security of Supply of Medical Radioisotopes.

During the year, the Agency cooperated with the European Nuclear Society in organizing the 19th International Topical Meeting on Research Reactor Fuel Management (RRFM), held in April in Bucharest, Romania, and attended by 211 participants from 31 Member States. The Agency cooperated with Argonne National Laboratory in organizing the 36th Annual International Meeting on Reduced Enrichment for Research and Test Reactors (RERTR), held in October in Seoul, Republic of Korea. The meeting drew 183 participants from 21 Member States.

The Agency continued to support Member State requests to minimize civilian use of HEU. In July, it held a meeting, in cooperation with the National Academy of Sciences of the United States of America, to update a list of operational civilian research reactor facilities that use HEU fuel; 24 participants from five Member States attended. During the year, the Agency provided support for the conversion of the Jamaican Slowpoke reactor to an LEU core, which took place in September.

The Agency continued to support Ghana in its efforts to convert the core of its Miniature Neutron Source Reactor (MNSR) from HEU to LEU fuel and to return the HEU core to China, a step expected to occur in 2016. In February, the Agency received a request for assistance from the Syrian Arab Republic for the conversion of the core of its MNSR from HEU to LEU fuel, and the return of the HEU core to China. In December, representatives of Member States hosting an MNSR, and stakeholders supporting the conversion of MNSR cores from HEU to LEU fuel and the return of HEU to the country of origin, participated in a Technical Meeting on the Conversion of Miniature Neutron Source Reactors, held in Vienna. During the meeting, all Member States with MNSRs confirmed their interest in the conversion of their reactors.

During the year, 26.6 litres of liquid HEU fuel from Uzbekistan (Fig. 2) and 1.9 kilograms of fresh HEU fuel from Georgia was repatriated to the Russian Federation. With the shipments, Uzbekistan and Georgia became free of HEU.

In June, Uzbekistan hosted the Ninth Technical Meeting on Lessons Learned from the Russian Research Reactor Fuel Return (RRRFR) Programme, attended by 81 participants

FIG. 2. A truck carrying a transport canister with irradiated liquid HEU fuel drives into a cargo plane for repatriation of the fuel to the Russian Federation.

from 21 Member States. The event included updates on the repatriation programmes for HEU research reactor fuel originating from China, the Russian Federation and the United States of America.

Accelerator Applications

In view of the growing number of accelerator applications, the Agency hosted a side event entitled 'Socio-economic Impact of Accelerator-based Research' at the 59th regular session of the General Conference. During the event, international experts highlighted the unique role of particle accelerators in modifying materials and providing analytical and structural information for research.

In 2015, the Agency launched the Accelerator Knowledge Portal, providing access to a variety of information for accelerator scientists, users and service providers worldwide. The Portal contains details on 200 linear electrostatic accelerators from 49 Member States and on 57 synchrotron light sources from 22 Member States.

The Agency also co-organized the 12th International Topical Meeting on Nuclear Applications of Accelerators (AccApp'15), held in Washington, DC, during the American Nuclear Society (ANS) Winter Meeting. Meeting participants discussed the results of a recently completed CRP entitled 'Accelerator Simulation and Theoretical Modelling of Radiation Effects (SMoRE)'. The project focused on the use of ion beams to simulate fast neutron damage to candidate fuel cladding and pressure vessel materials for future reactors. The long term stability of a variety of structural alloys and other materials was studied, along with their mechanical properties, microstructural changes and irradiation resistance. The CRP resulted in several advances in multiscale modelling of radiation effects, especially in the area of iron-chromium and oxide dispersion strengthened (ODS) alloys.

"In 2015, the Agency launched the Accelerator Knowledge Portal.... [containing] details on 200 linear electrostatic accelerators from 49 Member States and on 57 synchrotron light sources from 22 Member States."

Synchrotron applications

The IAEA–Elettra Sincrotrone Trieste joint experimental facility provides access to synchrotron radiation for Member States, enabling them to carry out experiments for environmental and industrial applications. During 2015, 16 research groups from 14 Member States utilized 159 beam-time shifts (53 days). The groups also made use of the analytical capabilities of the Agency's multipurpose X ray spectrometry at the X ray fluorescence beam line. The results obtained indicate potential for its use in analysis of a variety of materials.

In 2015, the Agency entered into a cooperation agreement for the First African Light Source Conference and Workshop. The aim is to bring the first synchrotron to Africa, the only continent without one.

Materials modification and analysis with accelerator-based techniques

Focused megaelectronvolt ion beams are ideal tools for investigating the effects of radiation induced displacement damage on the electronic performance of semiconductor devices. Participants in the recently completed CRP entitled 'Utilization of Ion Accelerators for Studying and Modelling of Radiation Induced Defects in Semiconductors and Insulators' developed a theoretical model and a corresponding experimental protocol to establish a methodology to characterize the radiation damage of a semiconductor and insulator materials as an irradiation-independent physical value.

To discuss the possible effects of radiation on heritage objects during ion and photon beam experiments, and to suggest safer procedures and improved practices for monitoring and mitigation strategies, the Agency held a Technical Meeting in the Palais de Louvre in

France, co-organized by the Centre for Research and Restoration of the Museums of France (C2RMF) and the French laboratory IPANEMA. The event was unique in providing a common platform for physicists, chemists, materials scientists, archaeologists, conservators and curators.

Nuclear Instrumentation

Through scientific visits to, and fellowships and internships at, its Nuclear Science and Instrumentation Laboratory in Seibersdorf, as well as training sessions in Member States, the Agency provided 32 young experts from 17 Member States with training in areas ranging from signal processing to hardware interfacing and data acquisition and analysis.

During the year, the Agency also began testing a system to enable rapid environmental mapping of radioactivity using unmanned aerial vehicles, developed in the wake of the accident at the Fukushima Daiichi nuclear power plant. The new system, which is based on radiation detectors and sensor packages mounted on a customized hexacopter, was created in collaboration with Fukushima Prefecture.

"the Agency…began testing a system to enable rapid environmental mapping of radioactivity using unmanned aerial vehicles"

Nuclear Fusion

In the area of nuclear fusion, the Agency worked to consolidate design choices and technologies for ITER — a project to demonstrate self-sustained fusion energy generation in excess of 500 MW — and to close the gaps between ITER and a demonstration fusion plant at industrial scale (Fig. 3). Around 650 experts from 30 Member States addressed various physics and technology issues in 12 Technical Meetings and workshops conducted in 2015. A side event on fusion held during the General Conference summarized the status of fusion research around the world. Also during the year, the Agency organized the third Demonstration Fusion Power Plant (DEMO) Programme Workshop. This year's workshop, held in May, was hosted by the Institute of Plasma Physics of the Chinese Academy of Sciences, Hefei, China.

FIG. 3. Aerial view of ITER site as of September 2015.

Food and Agriculture

Objective

To contribute to sustainable intensification of agricultural production and the improvement of global food security by addressing the challenges of food production, food protection and food safety through capacity building in and technology transfer to Member States.

Sustainable Management of Major Insect Pests

The Agency supports around forty field projects involving the application of the sterile insect technique (SIT). Among these is a project in Senegal that has improved food security and public health in target areas in the western part of the country. At Expo Milano 2015, this tsetse eradication project was selected from among 749 projects as one of the 18 Best Sustainable Development Practices on Food Security for its contribution to furthering sustainable development of small rural communities in marginal areas.

The Agency also supported the application of SIT to control the Mediterranean fruit fly in the Latin America and the Caribbean region during the year. After a large outbreak was detected in the Dominican Republic, importers of Dominican horticultural products closed their markets, leading to major economic losses. The country's Ministry of Agriculture launched an emergency response programme in early 2015, with the Agency, the Food and Agriculture Organization of the United Nations (FAO) and other partners providing extensive technical assistance. As a result, the expanding outbreak was contained during the year; a major eradication campaign is under way, involving the release of sterile male insects to completely eliminate this pest.

The stable fly (*Stomoxys calcitrans*) affects the Costa Rican livestock industry, causing major losses of animal productivity. The proliferation of the stable fly, which grows on pineapple residues from large farms, has become a serious problem. In 2015, a technical cooperation project was implemented to develop capacities at the National Institute of Agricultural Technology Innovation and Transfer in Costa Rica to address the issue. The Agency worked with Costa Rican counterparts to build capacity to mass rear *Spalangia endius* wasps as a means of biological pest control. *Spalangia endius* is a parasite of the stable fly and naturally suppresses stable fly populations. The wasps are produced on irradiated stable fly larvae so that larvae that are not parasitized cannot become fertile flies when released together with the parasitoids.

During the year, a coordinated research project (CRP) entitled 'Resolution of Cryptic Species Complexes of Tephritid Pests to Overcome Constraints to the Application of the Sterile Insect Technique and International Trade' was completed. The results of the CRP, which studied African, Asian and Latin American fruit fly cryptic pest complexes, were published in a special issue of the peer-reviewed scientific journal *ZooKeys* (Fig. 1).

FIG. 1. Fruit fly cryptic species: South American fruit fly, Anastrepha fraterculus *(A), Natal fruit fly,* Ceratitis rosa *(B), melon fly,* Zeugodacus cucurbitae *(C), Oriental fruit fly,* Bactrocera dorsalis *(D). (Photographs courtesy of: (A) Michal Hoskovec; (B) and (C) Antoine Franck; and (D) Ana Rodriguez.)*

Animal Production and Health

The Agency continued its contributions to strengthening regional capacities for early detection of emerging and re-emerging zoonotic diseases in wildlife and livestock, and the establishment of early warning systems. Particular attention was given to the Ebola virus disease (EVD) and the highly pathogenic H5N1 avian influenza. During the year, the Agency's Board of Governors approved an off-cycle technical cooperation project targeting emerging zoonotic diseases (including EVD), and additional reserve fund projects were approved to provide targeted support to Burkina Faso, Côte d'Ivoire, Ghana, Niger and Nigeria on H5N1. These activities received strong technical and financial support from the Peaceful Uses Initiative (PUI) and the African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA).

"the Agency, in collaboration with FAO, provided diagnostic toolkits, validated guidance and standard operating procedures, and supplied on-line support for the expert missions."

Globally, outbreaks of H5N1 have killed millions of birds, and 60% of all humans infected with this deadly virus have died. In early 2015, a highly pathogenic H5N1 strain re-emerged in western Africa. In response to requests by Member States in the region, the Agency provided support through the Veterinary Diagnostic Laboratory (VETLAB) network of veterinary institutions and laboratories and through the technical cooperation programme.

Expert missions including staff of the Joint FAO/IAEA Division, together with external avian influenza experts, were sent to Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, Nigeria, Senegal, Togo and other countries in the region, to address diagnostic needs (Fig. 2). These

FIG. 2. The Agency contributed to strengthening capacities for early and rapid diagnosis of avian influenza in animal populations in 2015.

missions proved to be very successful in the rapid diagnosis of the disease. As part of the emergency response, the Agency, in collaboration with FAO, provided diagnostic toolkits, validated guidance and standard operating procedures, and supplied on-line support for the expert missions.

Food Safety and Control

"Fifteen irradiation treatment methods included in International Plant Protection Convention standards were developed in joint FAO/IAEA coordinated research projects."

To promote food safety, the Agency continued to facilitate laboratory networks to enable Member States to share technical expertise, supply chain information, experience and resources. The initial focus of network building was in the Latin America and the Caribbean region, and in 2015 this successful initiative was extended to both Africa and Asia.

In 2015, the Agency held 36 training courses and workshops related to food safety, quality, authenticity and traceability. It also hosted, developed and maintained the Food Contaminant and Residue Information System (FCRIS). This free on-line resource provides information on different methods of analysis and on food contaminants and residues, including chemical and toxicological data on pesticides and veterinary drugs. At the end of the year, 110 veterinary drug or pesticide residue analysis methods were available on FCRIS, an increase of over 20% compared with 2014.

Standards and guidelines developed by the Agency in collaboration with Member States and other international organizations provide the framework for promoting trade in irradiated foods. Fifteen irradiation treatment methods included in International Plant Protection Convention standards were developed in joint FAO/IAEA coordinated research projects. The Agency also published a new *Manual of Good Practice in Food Irradiation: Sanitary, Phytosanitary and Other Applications* (Technical Reports Series No. 481) to support the uptake and implementation of the technology. The increasing commercial use of irradiation as a phytosanitary treatment is helping producers overcome insect pest related trade restrictions and reach markets that would otherwise be closed to them.

Mutation Breeding for Crop Improvement

Climate influences both the yield and the quality of crop plants. The negative effects of climate variability and conditions such as floods, drought, heat and salinity are major constraints affecting sustainable agricultural productivity around the world. Mutation breeding techniques and related biotechnologies are important tools for meeting this challenge. Mutation breeding has been used successfully to improve crops for over 70 years, with 3233 mutant varieties released during that time.

With Agency support, in 2015 Mongolia released a new wheat mutant variety — Darkhan-141 — for use as both food and animal feed. Darkhan-141 is resistant to lodging (bending of the stem) and drought, and has higher productivity than other varieties suitable for production under the country's climatic conditions.

Through national and regional technical cooperation projects, the Agency supported Malaysia in developing two rice mutants with high yield under minimal water conditions. These drought tolerant mutants have great potential for use in a broad range of the rice growing areas in Malaysia. The mutant lines were registered in 2015, and one is expected to be officially released in 2016. A technology package provided to farmers including the mutant variety and a biofertilizer doubled the yield of rice on two experimental sites.

In 2015, the Agency launched a new CRP entitled 'Efficient Screening Techniques to Identify Mutants with Disease Resistance for Coffee and Banana', to combat pathogens that attack these important crops. As part of the CRP, mutation techniques will be used to develop new varieties with resistance to these biotic stresses.

The Agency completed a technical cooperation project entitled 'Assessing Crop Mutant Varieties in Saline and Drought Prone Areas Using Nuclear Techniques' in 2015. Through technology transfer and capacity building, the Agency helped Bangladesh to develop a total of 13 mutant varieties of rice through the application of mutation breeding techniques. The development of a number of high yield crop varieties helped farmers in the country to adapt to changing climatic conditions, thus mitigating the effects of failed or low yield harvests. The project successfully addressed both drought and saline soil conditions — two environmental challenges affecting crop yield that require different crop mutations for ideal climatic adaptation. The increased food and economic security resulting from these crop varieties are already having a positive effect on the livelihoods of farmers in the country.

"The development of a number of high yield crop varieties helped farmers… to adapt to changing climatic conditions."

Land and Water Management

Land degradation costs US $10.6 trillion around the world each year, and soil erosion is the main contributor. About 75 billion tonnes of fertile soil is lost each year through soil erosion. This loss of land increases sedimentation in streams and rivers, and can lead to flooding. Sustainable land use can help to reduce the impacts on agriculture and livestock, and can prevent soil degradation and erosion, and the loss of valuable land.

Fallout radionuclides are robust, cost effective tools for tracing and quantifying soil redistribution and sources of erosion within agricultural landscapes, so that soil conservation practices can be implemented to minimize this loss. Through two technical cooperation projects, the Agency assisted Member States in Africa and in the Asia and the Pacific region in using this technique to address soil erosion. In 2015, the Agency used nuclear techniques to identify the sources of soil erosion, and to quantify soil erosion rates, for 27 study sites in a 10 000 km² area of Lam Dong Province in the southern part of the central highlands of Viet Nam. The study showed that soil losses from erosion could be reduced by 47% through intercropping on coffee or tea tree plantations; using vetiver grass hedgerows and green manure management; creating water catchment basins at the base of coffee trees; and using contour and terraced farming. If applied to the total area of land affected by soil erosion in Viet Nam, these practices would result in a reduction of fertilizer use totalling US $74 million.

In 2015, the Agency joined the global community in celebrating the International Year of Soils by hosting a major event to commemorate World Soil Day in December. Also that month, an article on the Agency's work in this area was published in *National Geographic*, highlighting how nuclear techniques can help in assessing and curtailing the worldwide threat of soil erosion.

Human Health

Objective

To enhance capabilities in Member States to address needs related to the prevention, diagnosis and treatment of health problems through the development and application of nuclear techniques within a framework of quality assurance.

Linkages between Poor Sanitation and Undernutrition

Environmental enteric dysfunction (EED) is strongly associated with stunting and other forms of undernutrition. Stunting is caused by long term poor health and poor nutrition, but unsanitary conditions are considered to be an important part of the problem (Fig. 1). Living in poor sanitary conditions may lead to gut function disorders and chronic inflammation, both of which are evident in EED.

To address this problem, the Agency brought together fifty experts from academia and organizations such as the Bill and Melinda Gates Foundation and the World Bank to participate in a three day meeting at the Agency's Headquarters in October. The experts considered the current knowledge as well as knowledge gaps concerning the definition, biological pathways and consequences of EED. They also considered prevention and treatment options, including areas where the Agency can play an important role by supporting the use of stable isotope techniques.

FIG. 1. Understanding EED can improve nutrition interventions and human health.

The meeting participants concluded that several gaps in knowledge require urgent attention, in particular the need for the classification of EED and a better understanding of its underlying causes. They strongly recommended that practical, simple, affordable tools be developed to diagnose and characterize EED, to allow better targeting of interventions in vulnerable populations. The recommendations from the meeting will be used for planning a coordinated research project in this area.

Global Educational Outreach in Nuclear Medicine and Radiology

Information and communication technologies continued to play a major role in the Agency's growing education, training and outreach activities throughout the year. Such technologies enable the Agency to provide more information to Member States more quickly and more effectively.

In 2015, the Agency broadcast six on-line human health seminars during the year, with an average of 200 participants per seminar. Targeting mainly nuclear medicine physicians, radiologists and medical residents in training, these webinars focused on clinical aspects of nuclear medicine with an emphasis on nuclear cardiology and paediatric nuclear medicine. Other webinars focused on normal anatomy and common pathological findings in a live, interactive, case based format simulating clinical practice.

"the Agency broadcast six on-line human health seminars during the year, with an average of 200 participants per seminar."

The Agency also released new educational materials through the Human Health Campus, including new e-learning modules on quality assurance for single photon emission computed tomography (SPECT) systems. Other topics included energy resolution, uniformity, tomographic sensitivity and measurement of SPECT gamma camera performance. A module entitled 'Atlas of Myocardial Perfusion SPECT Studies' was also released during year, aimed at nuclear medicine physicians practising in the field of nuclear cardiology.

To support Member State efforts to combat cancer, the Agency and the Tata Memorial Centre in Mumbai, India, developed a smart phone application for cancer staging. The app, which was launched during the 59th regular session of the Agency's General Conference, can be used by the global medical community for rapid, accurate and standardized staging of cancer. Based on this classification, physicians can decide on the most appropriate treatment for each cancer patient.

In October, the Agency hosted the International Conference on Clinical PET–CT and Molecular Imaging (IPET-2015): PET–CT in the Era of Multimodality Imaging and Image Guided Therapy. The conference, held in Vienna and attended by more than 500 professionals from over 90 Member States, emphasized important clinical aspects and appropriate use of hybrid imaging (e.g. single photon emission computed tomography–computed tomography (SPECT–CT), positron emission tomography–computed tomography (PET–CT)) for the entire spectrum of cancer management. For the first time, the conference sessions were streamed live over the Internet to reach a broader audience of medical experts around the world. After fulfilling the rigorous requirements of the European Accreditation Council for Continuing Medical Education, IPET-2015 was granted 27 European Continuing Medical Education credits by the European Accreditation Council for Continuing Medical Education.

The Agency issued a number of publications on nuclear medicine and diagnostic imaging in 2015. Three books were published in the IAEA Human Health Series: *Radiolabelled Autologous Cells: Methods and Standardization for Clinical Use* (IAEA Human Health Series No. 5); *Clinical PET/CT Atlas: A Casebook of Imaging in Oncology* (IAEA Human Health Series No. 32); and *Quality Management Audits in Nuclear Medicine Practices: Second Edition* (IAEA Human Health Series No. 33). The Agency also published seven articles in peer-reviewed journals, including an article in the *European Heart Journal* entitled

"Current Worldwide Nuclear Cardiology Practices and Radiation Exposure: Results from the 65 Country IAEA Nuclear Cardiology Protocols Cross-Sectional Study (INCAPS)".

Radiation Oncology and Biology

Contouring of tumours and normal structures as part of the radiotherapy treatment planning process is an important aspect of effective radiotherapy. Such contouring is challenging to teach because it requires guided, hands-on practice in addition to anatomical knowledge. To assist Member States in filling this crucial training need, the Agency organized a contouring workshop in Vienna in June, attended by 21 delegates and five trainers from 24 Member States. The workshop included an introduction to radiotherapy planning, followed by segments focusing on five common cancers: head and neck, lung, breast, prostate and rectal cancer.

At the 3rd European Society for Radiotherapy and Oncology Forum, held in Barcelona in April, a session was dedicated to presenting seven Agency coordinated research projects on radiotherapy. The projects included five trials on treatment of cancers of the head and neck, breast, rectum, bone and lung, and two surveys of capacity in developing countries. The abstracts were published in the journal *Radiotherapy and Oncology* in April.

"The evaluation found QUATRO audits to be a valuable tool for identifying Member State needs in terms of infrastructure, human resources and radiotherapy procedures."

In September, the Agency, in cooperation with the National Institute of Radiological Sciences of Japan, held a Technical Meeting on the Future of Biodosimetry in Asia: Promoting a Regional Network. The meeting was attended by 24 participants from 16 countries, who discussed the future direction of and new developments in biological dosimetry, and the possibility of establishing a research oriented biodosimetric network in the Asia and the Pacific region.

Between 2008 and 2013, the Agency carried out pilot audits of 12 radiotherapy departments in Latin America using the Quality Assurance Team for Radiation Oncology (QUATRO) guidelines. An evaluation of these pilot audits was published in August in an article in the journal *Radiation Oncology* entitled "Quality audits of radiotherapy centres in Latin America: a pilot experience of the International Atomic Energy Agency". The evaluation found QUATRO audits to be a valuable tool for identifying Member State needs in terms of infrastructure, human resources and radiotherapy procedures.

The Agency provided data from its Directory of Radiotherapy Centres for The Lancet Oncology Commission's report entitled "Expanding Global Access to Radiotherapy". The report was published in *The Lancet Oncology* in September and presented at the European Cancer Congress in Vienna later that month.

Quality Assurance and Metrology in Radiation Medicine

Quality control is essential to the safe and effective use of radiation technology in medicine. To support Member State implementation of quality assurance programmes in radiotherapy, the Agency published two new IAEA Human Health Reports in 2015: *The Transition from 2-D Brachytherapy to 3-D High Dose Rate Brachytherapy* (IAEA Human Health Reports No. 12) and *Staffing in Radiotherapy: An Activity Based Approach* (IAEA Human Health Reports No. 13 (CD-ROM)).

In the field of radiology physics, the Agency, in cooperation with the World Health Organization (WHO), published a comprehensive resource guide entitled *Worldwide Implementation of Digital Imaging in Radiology* (IAEA Human Health Series No. 28). The book provides information on developing and implementing a sustainable digital imaging and teleradiology system, and on requirements for the transition from film to digitally based medical imaging. The Agency also published *Nuclear Medicine Physics: A Handbook for Teachers and Students*, the third and final volume in a series of comprehensive handbooks

on medical radiation physics. Endorsed by medical physics associations around the world, including the American Association of Physicists in Medicine, the Asia–Oceania Federation of Organizations for Medical Physics, and the European Federation of Organisations for Medical Physics, the Handbook is expected to become a reference textbook for postgraduate medical physics education programmes.

In June, the Agency held its first train the trainer workshop on medical physics for nuclear or radiological emergencies. Held in Fukushima Prefecture, the workshop was supported by the Fukushima Medical University, the National Institute of Radiological Sciences of Japan and the Japan Society of Medical Physics. It was attended by 21 participants from 17 countries.

To support Member States in strengthening their dosimetry capabilities in radiation medicine, the Agency provides calibration and audit services to secondary standards dosimetry laboratories (SSDLs) and radiotherapy centres. Since 1969, the IAEA–WHO thermoluminescent dosimeter (TLD) postal dose audit service has checked 11 500 radiotherapy beam calibrations in 132 countries. In 2015, over 600 hospital beam audits were conducted, with 21 repeat checks to follow up dosimetry discrepancies. Without such audits, discrepancies might not be discovered, and patients might not receive the correct treatment.

"In 2015, over 600 hospital beam audits were conducted, with 21 repeat checks to follow up dosimetry discrepancies."

During the year, the Agency performed calibrations of national dosimetry standards for 19 SSDLs and conducted ten interlaboratory comparisons for radiotherapy dosimetry. In November, an international workshop to compare the national reference standards for radiation protection dosimetry of six Member States was held at the IAEA's Dosimetry Laboratory (Fig. 2). The results were used to determine the level of equivalence with international standards.

In 2015, the Agency successfully tested a new optically stimulated luminescence dosimetry (OSLD) system for use in radiation protection audits of SSDLs. The new OSLD system replaced the manual TLD system and will be used for future audits in radiation protection dosimetry.

FIG. 2. Participants in an international dosimetry workshop held at the IAEA's Dosimetry Laboratory in November.

As part of the Renovation of the Nuclear Applications Laboratories (ReNuAL) project, in 2015 the Agency acquired a new high dose rate brachytherapy unit through an extrabudgetary contribution from Germany. The unit will be used for dosimetry calibrations for SSDLs, thus contributing to increased consistency in brachytherapy dosimetry around the world.

Water Resources

Objective

To enable Member States to use isotope hydrology for the assessment and management of their water resources, including characterization of climate change impacts on water availability.

Water Resource Assessment

The IAEA Water Availability Enhancement (IWAVE) Project, which is being piloted in Costa Rica, Oman and the Philippines, reached significant milestones in 2015. National workshops held in Oman and the Philippines brought together different local, regional and federal water resource agencies to discuss the achievements to date; a national workshop for Costa Rica is planned for early 2016. Among the achievements highlighted were strengthened collaboration among government agencies; recognition of the importance of comprehensive water resource assessment; strengthened capacity to conduct surface water and groundwater assessments; and improved synthesis and evaluation of hydrological data. In the Philippines, the project led to improved assessments of water resources and groundwater vulnerability in two regions of the country. In Oman, the project focused on water resource evaluation in the Samail catchment near Muscat. In Costa Rica, participants developed comprehensive maps showing the distribution of the isotope content of precipitation. These maps will be used in connection with studies to evaluate sources of recharge of major springs near the mountain ranges and water sources along the Pacific coast.

"the Agency strengthened Member State capacity for carrying out isotope based evaluations of groundwater resources through a series of field studies"

More than half of all fresh water used for domestic and agricultural use worldwide comes from groundwater resources. Understanding the age of groundwater, and therefore aquifer renewability, is critical for sustainable water management. During the year, the Agency strengthened Member State capacity for carrying out isotope based evaluations of groundwater resources through a series of field studies in Estonia, Hungary, Thailand, Tunisia and Viet Nam. These studies tested the use of krypton-81 for measuring the age of very old groundwater. Results indicate that many of the aquifers tested have groundwater ages of 50 000 to 600 000 years, which is much older than previously considered. Krypton-81 can be used to measure the age of groundwater in a wide range of climates and aquifer conditions, allowing the Agency to assist many more Member States in using this technique.

The Agency helped develop better methods for using isotopes for aquifer characterization and management through work carried out in three coordinated research projects (CRPs) that were completed in 2015. Participants in a CRP entitled 'Estimation of Groundwater Recharge and Discharge by Using the Tritium, Helium-3 Dating Technique' tested the tritium–helium-3 isotope method and reviewed the results obtained from 600 water samples collected under different hydrological settings. The findings of this CRP will be useful in technical cooperation projects that make use of this methodology. In a second

FIG. 1. Sampling of groundwater discharging into rivers through the subsurface.

CRP, entitled 'Environmental Isotope and Age Dating Methods to Assess Water Quality in Rivers Affected by Shallow Groundwater Discharges', ten Member States evaluated the use of multiple isotope tracers to assess the impact of groundwater discharge on water quality in rivers (Fig. 1). At the CRP's third meeting, held at the Agency's Headquarters in May, participants reviewed existing and new approaches to assessing transport processes of water and pollutants based on environmental tracers. In October, the Agency held the final Research Coordination Meeting of a CRP entitled 'Use of Environmental Isotopes to Assess Sustainability of Intensively Exploited Aquifer Systems'. Participants from ten Member States reviewed the results of assessments carried out in aquifers located under different climatic and hydrological settings, and produced a synthesis of their findings.

Fourteen Member States (Australia, Bangladesh, India, Indonesia, Republic of Korea, Malaysia, Mongolia, Myanmar, New Zealand, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam) participated in a regional technical cooperation project entitled 'Applying Isotope Techniques to Investigate Groundwater Dynamics and Recharge Rate for Sustainable Groundwater Resource Management'. The project focused on issues concerning the recharge rate and dynamics of groundwater, and used isotope techniques to study specific groundwater issues in each Member State. At the project's final progress review meeting, held in Bali, Indonesia, in November, participants concluded that the project had achieved its goals of developing institutional capability in isotope hydrology, establishing a comprehensive database of isotopes and chemical constituents, and promoting a better understanding and a greater appreciation of the techniques used.

Climate Change Impacts

An Agency CRP entitled 'Stable Isotopes in Precipitation and Paleoclimatic Archives in Tropical Areas to Improve Regional Hydrological and Climatic Impact Models' aims at developing new methods of using isotopic techniques to understand and monitor the impacts of climate change. At the CRP's second Research Coordination Meeting, held in

Vienna in June, the 12 participating Member States examined stable isotopes in rain and snow to evaluate the main factors controlling their distribution. The results were used to develop a plan for further testing and analysis, which will be reviewed in the CRP's final meeting.

In November, the Agency held a training course on the application of isotopes for monitoring river hydrology, including impacts of climate change. Participants from 11 Member States attended the two week course, which provided training in the use of isotopes for evaluating the source of water and pollutants in rivers; geochemical processes that affect water quality; and long term monitoring using isotopes.

"In November, the Agency held a training course on the application of isotopes for monitoring river hydrology, including impacts of climate change."

The final results of a CRP entitled 'Use of Environmental Isotopes in Assessing Water Resources in Snow, Glacier and Permafrost Dominated Areas under Changing Climatic Conditions' were published in 16 peer-reviewed scientific papers. Twelve Member States participated in the CRP, performing research to quantify the contribution of snow, glaciers and permafrost to rivers and groundwater recharge (Fig. 2). The papers reported on the field testing of an innovative sampling device to collect samples of snowmelt and demonstrated the distinct isotopic labelling of various sources of water.

FIG. 2. Ice coring (up to a depth of 181.8 m) from the glacier at Elbrus Mountain, Russian Federation, for investigation of the palaeoclimate isotope record.

Analytical Capacity and Services

Thirteen Member States took part in a one week training course, held in Vienna in October, on low level tritium analyses for hydrological studies using a system developed by the Agency. The new system is easy to operate and costs about 25% of the cost of existing systems. The Agency also developed a computer program to enable standardized collection and evaluation of data on tritium. The program has been made available to Member State laboratories through the Agency's web site to facilitate its wider use and to improve laboratory performance.

Through training provided in the framework of its technical cooperation programme, the Agency assisted nine Member State laboratories in strengthening their capacity to carry out stable isotope analysis using laser spectroscopy. A total of 58 laser spectroscopy laboratories have been established in 53 Member States over the past eight years, contributing to national and regional technical cooperation projects.

"the Agency assisted nine Member State laboratories in strengthening their capacity to carry out stable isotope analysis using laser spectroscopy."

As many Member States have increased their capacity for stable isotope analysis, the Agency's Isotope Hydrology Laboratory has been able to shift a portion of its efforts away from supplying routine services in support of technical cooperation projects. Instead, in 2015 the focus was increasingly on supporting analytical services for global isotope monitoring networks and laboratory intercomparison exercises, and on facilitating wider participation in CRPs by Member States that do not have their own laboratory. During the year, some 7000 samples were analysed for stable oxygen and hydrogen isotopes, 400 for tritium and 320 for noble gas isotopes.

In 2015, the Agency installed a new mass spectrometer, expanding its capacity to provide analytical services to Member States for groundwater age dating using noble gas isotopes. The new equipment doubles the number of samples that can be analysed for technical cooperation and research projects.

Environment

Objective

To identify environmental problems caused by radioactive and non-radioactive pollutants and climate change, using nuclear, isotopic and related techniques, and to propose mitigation/adaptation strategies and tools. To enhance the capability of Member States to develop strategies for the sustainable management of terrestrial, marine and atmospheric environments and their natural resources, in order to address effectively and efficiently their environment related development priorities.

ALMERA

The Agency's global Analytical Laboratories for the Measurement of Environmental Radioactivity (ALMERA) network celebrated its twentieth anniversary in 2015. Since its founding in 1995, the network has grown from 24 laboratories in 15 Member States to 156 laboratories in 85 Member States. ALMERA has contributed significantly to harmonizing methods for natural and anthropogenic radionuclide analysis of environmental samples. In 2015, in response to Member State interest in high throughput radiochemical methods, particularly in emergency situations, the Agency and the ALMERA network began development and validation of methods for rapidly determining radiostrontium in soil and seawater.

"the Agency and the ALMERA network began development and validation of methods for rapidly determining radiostrontium in soil and seawater."

During the year, the Agency coordinated two training activities to address priorities identified by ALMERA members. In May, a two week training course on methods for rapid assessment of environmental radioactivity was organized in collaboration with Argonne National Laboratory (ANL) in the United States of America. The laboratory based training, held at ANL with 22 participants from 20 Member States, focused on the rapid determination of plutonium isotopes and americium-241 in soil and sediment samples using alpha spectrometry, based on an ALMERA validated method. The course included a practical exercise on evaluation of complex gamma spectra of environmental samples, a field exercise on detection and sampling in cases of environmental contamination, and specific applications of the RESRAD (RESidual RADioactivity) dose assessment tool.

The second training course, held in November, provided instruction on in situ gamma ray spectrometry. As in situ measurement techniques have an important role in nuclear and radiological emergency preparedness, the course prompted a high level of interest among the ALMERA members. Organized in collaboration with the Spiez Laboratory, the Federal Office of Public Health and the NBC (Nuclear Biological Chemical) Centre of Competence in Switzerland, the one week training course, hosted by the Spiez Laboratory, was attended by 24 participants from 23 Member States. The highlight of the training was a practical field exercise in which the participants carried out measurements in emergency conditions simulated with the short-lived radioactive gamma ray emitter technetium-99m (Fig. 1).

FIG. 1. Field gamma spectrometry training in Switzerland under simulated emergency conditions.

Environmental Monitoring

The Agency continued its focus on environmental monitoring in 2015. In response to a request from the Institute of Environmental Radioactivity of Fukushima University, it provided support for radioecological monitoring and remediation of forests. In the framework of an IAEA Action Plan on Nuclear Safety project entitled 'Marine Monitoring: Confidence Building and Data Quality Assurance', aimed at ensuring the quality of Japan's marine monitoring data, the Agency organized a proficiency test for determining radionuclides in seawater and conducted two interlaboratory comparisons for radionuclides in samples of seawater, sediment and fish (Fig. 2). The results of the test and the interlaboratory comparisons showed the performance of the participating laboratories to be very good. During the year, work concluded on a large scale technical cooperation project involving 23 countries in the Asia and the Pacific region. Carried out with funding

FIG. 2. Fish samples being prepared for an interlaboratory comparison of radionuclide measurements carried out by the Agency and laboratories in Japan.

from the Peaceful Uses Initiative, the project developed regional capacity for monitoring the possible impact of radioactive releases from the Fukushima Daiichi nuclear power plant on the marine environment.

In the framework of an agreement with the Regional Organization for the Protection of the Marine Environment (ROPME), the Agency analysed oyster and marine sediment samples from the ROPME Sea Area to determine levels of radionuclides, trace elements, organic contaminants and biotoxins related to harmful algal blooms. The analysis was part of the ROPME mussel watch programme, aimed at assessing marine pollution in the coastal zone of the participating Member States.

To support environmental monitoring in Member States, the Agency organized ten proficiency tests involving more than 490 laboratories to check their capabilities for analysis of radionuclides, trace elements or organic contaminants in environmental samples. The Agency also published four proficiency test reports on radionuclide analyses in seawater in the IAEA Analytical Quality in Nuclear Applications Series.

During the year, the Agency provided intensive training to support Member States in the remediation of sites contaminated by past uranium mining and milling activities. During a course hosted by ANL, participants were trained in the use of the RESRAD-BIOTA dose assessment tool for evaluating risk at radioactively contaminated sites. In the framework of the United Nations Environment Programme (UNEP) Mediterranean Action Plan, the Agency held two training courses at the IAEA Environment Laboratories in Monaco to support national marine pollution monitoring programmes in the Mediterranean region. The courses were designed to improve the analytical skills needed for determination of contaminants in marine samples (Fig. 3).

"the Agency organized ten proficiency tests involving more than 490 laboratories to check their capabilities for analysis of radionuclides, trace elements or organic contaminants in environmental samples."

FIG. 3. Sediment sampling (left) and laboratory training (right) for marine pollution monitoring as part of the Agency's support to participants in the UNEP Mediterranean Action Plan.

Development of Regional Networks

The Ocean Acidification International Coordination Centre (OA-ICC) continued to support the development of collaborative networks in areas where ocean acidification data are scarce. In 2015, the Latin-American Ocean Acidification Network (LAOCA) was established during an expert meeting in Chile supported by the OA-ICC. Discussions on creating similar networks took place at regional training courses on ocean acidification held in China in October, and in South Africa in November, which were attended by 54 participants from 27 Member States. During these initial discussions, Member States began to assess existing ocean acidification capacity, technical facilities and opportunities for collaboration, with the goal of producing joint project proposals.

During the year, the Agency began training representatives of Member States in the use of a radiotracer methodology developed at the IAEA Environment Laboratories to study the impact of ocean acidification. Training was provided via several technical cooperation projects, and the subject was included in the curriculum of a newly developed three week

training course entitled 'Marine Ecosystems and Industries at Risk: Impact of Multiple Stressors'. The course, organized jointly with ANL, was held at the IAEA Environment Laboratories in Monaco in November, and attended by 19 trainees from 16 Member States.

"the Agency began training representatives of Member States in the use of a radiotracer methodology developed at the IAEA Environment Laboratories to study the impact of ocean acidification."

In 2015, the Agency signed new practical arrangements to provide a framework for closer collaboration with Member States in different regions. An agreement with the UNEP Mediterranean Action Plan was signed to assist Member States in improving the quality of data from laboratories implementing marine pollution monitoring. The Agency also concluded three new practical arrangements: with the Commission on the Protection of the Black Sea Against Pollution, to strengthen data quality assurance for the analysis of contaminants in the marine environment; with the Secretariat of the Pacific Regional Environment Programme (SPREP), on ocean acidification, climate change, coastal pollution, pollution source identification and improvement of analytical quality; and with the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), on monitoring ocean acidification and pollution in the Red Sea and Gulf of Aden.

During the year, the Agency launched a coordinated research project on improving monitoring strategies for ciguatera fish poisoning and on method validation for an optimized receptor binding assay for the related biotoxin. It also signed a cooperation agreement with the Malarde Institute in French Polynesia, and participated in the first interagency meeting on ciguatera, with representatives of the World Health Organization, the Food and Agriculture Organization of the United Nations and the Intergovernmental Oceanographic Commission.

Radioisotope Production and Radiation Technology

Objective

To strengthen national capabilities to produce radioisotope products and radiopharmaceuticals and to apply radiation technology, thus contributing to improved health care and safe, clean industrial development in Member States.

The possible shortage of molybdenum-99 (^{99}Mo), the radioactive parent of the most widely used radioisotope in nuclear medicine, technetium-99m (^{99m}Tc), is still a major concern in Member States. A coordinated research project (CRP) involving 13 institutions from 10 Member States, aimed at addressing this issue, was completed in 2015. The project, entitled 'Accelerator-based Alternatives to Non-HEU Production of ^{99}Mo/^{99m}Tc', studied different aspects of cyclotron based ^{99m}Tc production, such as the preparation of targets, irradiation of targets under high beam currents, target processing, target recovery and quality control of the final product. The project demonstrated an alternative technology for producing ^{99m}Tc that is in the process of obtaining regulatory approval.

"The possible shortage of molybdenum-99 (^{99}Mo), the radioactive parent of the most widely used radioisotope in nuclear medicine, technetium-99m (^{99m}Tc), is still a major concern in Member States."

The Agency also completed a CRP on the development and preclinical evaluation of therapeutic radiopharmaceuticals based on monoclonal antibodies and peptides labelled with lutetium-177 (^{177}Lu) and yttrium-90 (^{90}Y) (Fig. 1). The project was aimed at promoting the production and quality control of new radiopharmaceuticals for targeted therapy based on radioimmunotherapy and peptide receptor based radionuclide therapy. As a result of this CRP, many laboratories in participating Member States are now able to develop suitable ^{177}Lu or ^{90}Y radiopharmaceuticals for radioimmunotherapy.

The Agency continued to support African Member States in addressing the significant shortage of qualified radiopharmacy professionals in the region. During the year, it finalized e-learning syllabi and workshop materials for a master of science degree in radiopharmacy and a postgraduate diploma course. It also facilitated the enrolment of three students from Africa — two from Kenya and one from Ethiopia — in a master of science programme in radiopharmacy in the former Yugoslav Republic of Macedonia.

In December, the Agency held a Technical Meeting on Regulatory Aspects of Radiopharmaceutical Production aimed at supporting national radiopharmaceutical regulators. The meeting was attended by 11 participants from 10 Member States, who highlighted the need for education, training and harmonization of regulations in the field. The meeting provided a unique opportunity for participants to share their experience, and to discuss national regulations and challenges.

Radiation Technology Applications

Radiation processing technologies are used in a number of green production processes in both developed and developing countries. The Agency supports Member States in using

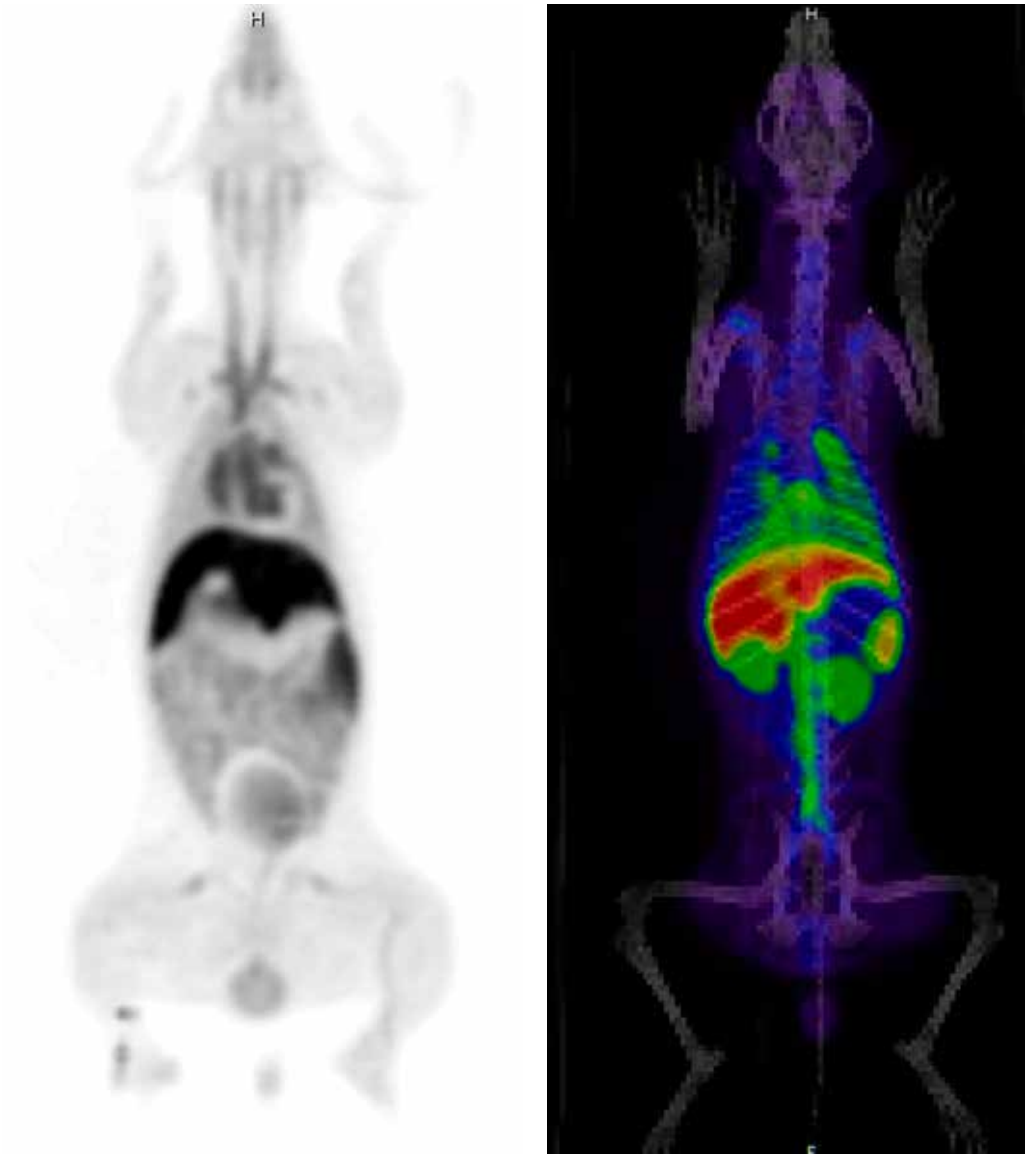

FIG. 1. Whole body imaging of a healthy beagle 24 hours after application of ^{177}Lu-Rituximab, one of the ^{177}Lu labelled monoclonal antibodies developed and evaluated as part of an Agency coordinated research project.

these technologies for a wide range of applications, from sterilization of single-use medical products to development of advanced materials for applications in medicine, agriculture and environmental remediation. Further expansion of their use depends on the availability of appropriately qualified personnel in research and development and in irradiation facilities, and on decision makers and end users being made aware of the potential of these technologies. In this context, a Technical Meeting on Enhancing Education Programmes for the Radiation Sciences in Cooperation with IAEA Collaborating Centres was organized in 2015 with representatives of universities, research organizations and Agency Collaborating Centres. The meeting drew 20 participants from 18 Member States, who identified needs and gaps in educational programmes and in access to radiation facilities, and suggested ways to address these issues. Participants also highlighted the important contributions of the Agency and its Collaborating Centres in this area.

The 2015 IAEA Scientific Forum, entitled Atoms in Industry: Radiation Technology for Development, brought together leading experts, academics and industrial representatives. Held at the Agency's General Conference in September, the Forum included presentations showcasing the important role that radiation technologies play in improving the quality of

products used in daily life. A panel discussion considered possible future developments and offered Member State representatives the opportunity to share their experience and their plans in the area of radiation technology. The Forum contributed to a better understanding of the role radiation technology plays in improving industrial products and processes in an environmentally sound way, and the ways it benefits both developed and developing countries.

Composite materials combine the properties of individual components to produce new materials used in a range of applications — from parts for the automotive and aerospace industries to food packaging materials and artificial organs. Materials reinforced with nanoscale components are adding new dimensions to composite materials and enabling major improvements in functional and structural properties. In 2015, the Agency completed a CRP on the use of radiation techniques to address Member State needs for advanced composite materials. Participating institutions developed methodologies and protocols for new abrasion resistant coating formulations, radiation curable nanocomposites from natural polymers, biodegradable packaging materials suitable for radiation sterilization, and methods for modifying surface characteristics of nanosized materials to enhance polymer filler interaction.

The fourth and final Research Coordination Meeting to review the results of a CRP on radiation treatment of wastewater for reuse, with a particular focus on wastewater containing organic pollutants, was held in 2015 at Tsinghua University in China. The CRP investigated how radiation treatment can be applied to address a wide variety of challenging pollutants in industrial and municipal wastewater and in wastewater originating from the pharmaceutical, textile, plastic and chemical industries. The CRP demonstrated that the use of radiation technology to treat organic contaminants in wastewater is economically competitive with other technologies, especially for pollutants that are currently problematic for industrial and municipal wastewater. The CRP also provided opportunities for training in various aspects of irradiation technology and resulted in a number of scientific publications as well as four patents.

"a CRP on radiation treatment of wastewater for reuse….demonstrated that the use of radiation technology to treat organic contaminants in wastewater is economically competitive with other technologies."

Management and conservation of natural resources is key to sustainable development. Nucleonic analysis and control systems, radiotracing technologies, and other relevant nuclear technologies have an important role to play in the optimization of resource based industries such as the mining, mineral and metallurgical industries. To support Member State use of nuclear technologies in these areas, the Agency launched a new CRP in 2015 entitled 'Development of Radiometric Methods for Exploration and Process Optimization in Mining and Mineral Industries'. The first meeting was held in December with 21 participants from 19 Member States.

Nuclear Safety and Security

Incident and Emergency Preparedness and Response

Objective

To maintain and enhance effective and compatible Agency, national and international emergency preparedness and response (EPR) capabilities and arrangements for early warning of and effective response to incidents and emergencies, independent of whether they arise from an accident, natural disaster, negligence or criminal act. To improve provision/sharing of information on nuclear or radiological incidents and emergencies among Member States, international stakeholders and the public/media.

Safety Standards and Guidelines

The Agency develops comprehensive international standards and guidance to support Member States in strengthening their emergency preparedness and response (EPR) arrangements and capabilities. In this connection, in 2015 the Agency published *Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSR Part 7). Jointly sponsored by 13 international organizations,[1] the publication establishes the requirements for ensuring an adequate level of preparedness and response for a nuclear or radiological emergency, irrespective of its cause.

During the year, the Agency also established the Emergency Preparedness and Response Standards Committee (EPReSC) under the Commission on Safety Standards. A total of 56 Member States and 11 international organizations nominated over 100 representatives to EPReSC. At its first meeting, in November, the Committee provided its action plan for the review of safety standards related to EPR and created two working groups: one to explore ways of improving communication to the public during an emergency, and the other to propose a revised and optimized EPR safety standards structure based on GSR Part 7.

[1] The Food and Agriculture Organization of the United Nations, International Atomic Energy Agency, International Civil Aviation Organization, International Labour Organization, International Maritime Organization, International Criminal Police Organization – INTERPOL, OECD Nuclear Energy Agency, Pan American Health Organization, Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization, United Nations Environment Programme, United Nations Office for the Coordination of Humanitarian Affairs, World Health Organization and World Meteorological Organization.

Response Arrangements with Member States

During 2015, the Agency conducted six Convention Exercises (ConvEx) with Member States and international organizations. These exercises are used to practise key elements of response arrangements such as the official information exchange protocols, the Agency's Unified System for Information Exchange in Incidents and Emergencies (USIE) and the process for provision of international assistance to a Member State. The Agency also participated in over 30 bilateral national exercises, in which the Agency and Member States practised international notifications and the exchange of information and results of assessment and prognosis during a nuclear emergency. The Agency conducted six workshops on notification, reporting and requesting assistance in 2015, with more than 80 participants from 30 Member States.

"The Agency conducted six workshops on notification, reporting and requesting assistance in 2015, with more than 80 participants from 30 Member States."

In April, the Agency hosted an International Experts Meeting on Assessment and Prognosis in Response to a Nuclear or Radiological Emergency. The meeting was attended by more than 200 experts from 70 Member States and 5 international organizations. It provided an important opportunity for participants to discuss, at the international level, the assessment and prognosis process during a nuclear or radiological emergency, including the Agency's role.

In 2015, the Agency launched the first test version of its International Radiation Monitoring Information System (IRMIS). The system provides Member States and the Agency with a mechanism to exchange and visualize large amounts of environmental radiation monitoring data during a nuclear or radiological emergency. IRMIS complements the USIE functionality and uses the International Radiological Information Exchange (IRIX) standard as the data exchange format.

The Agency also enhanced the communication and international assistance features of its secure USIE web site for reporting nuclear and radiological emergencies. The site now offers off-line completion of forms used in emergency communication and their subsequent submission to USIE and other emergency notification systems using the IRIX standard.

Response to Events

In 2015, the Agency was directly informed, or indirectly became aware, of 264 events involving or suspected to involve ionizing radiation (Fig. 1). It took response actions in 29 of these events. Six offers of good offices were made, including for events involving the loss of radioactive sources and those triggered by earthquakes.

Response and Assistance Network

The Agency's Response and Assistance Network (RANET) is made up of Member States that have registered their national assistance capabilities. The network is ready to provide assistance to States, upon request, during an emergency. In 2015, one additional Member State — the Republic of Korea — joined RANET, increasing the total membership to 28. In April, the Agency conducted a RANET Workshop on Monitoring during a Nuclear or Radiological Emergency, designed to assist Member States in building capacity and strengthening their EPR capabilities. Held at the Agency's RANET Capacity Building Centre in Fukushima Prefecture, Japan, the workshop was attended by 17 participants from 8 Member States.

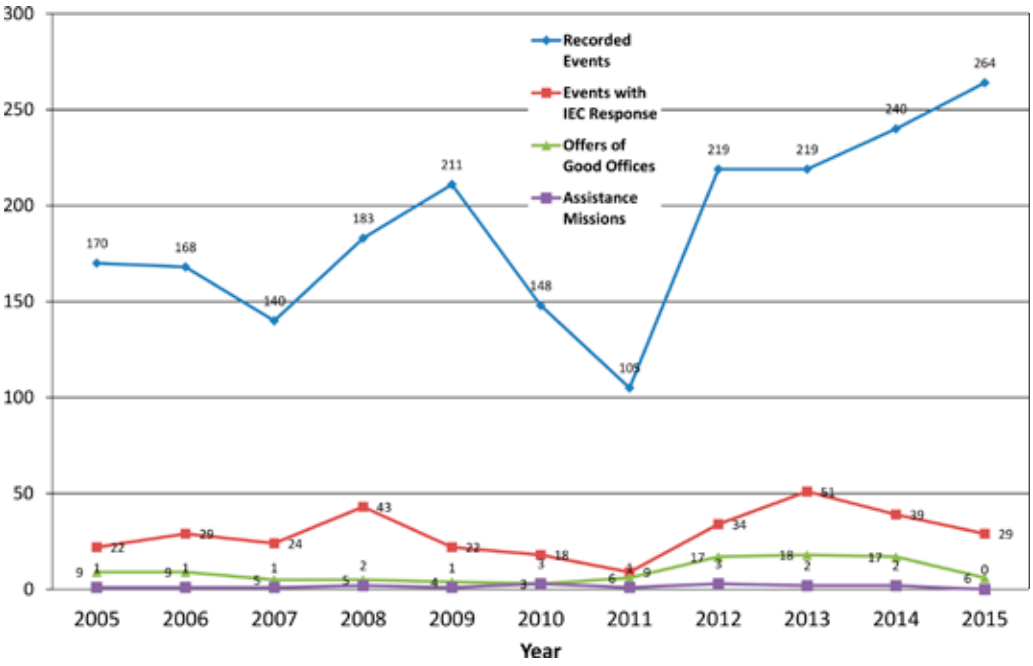

FIG. 1. Number of radiation events the Agency became aware of, and Agency responses, since 2005.

In-house Preparedness and Response

The Agency conducted a comprehensive programme of training, drills and exercises in 2015 to enhance the skills and knowledge of Agency staff members who serve as qualified responders under the Incident and Emergency System (Fig. 2). The programme offered approximately 130 hours of training during the year, including 78 training classes delivered to over 170 Agency staff responders. The exercises were used to test various elements of the response arrangements, including the notification and exchange of official information, the provision of public information, and the assessment and prognosis process.

FIG. 2. Agency staff responders during an internal exercise in 2015.

Strengthening Emergency Preparedness Arrangements

The Agency conducts international peer review missions to assist Member States in enhancing their emergency arrangements. These include advisory missions on EPR, Emergency Preparedness Review (EPREV) missions and a module of the Integrated Regulatory Review Service (IRRS) missions. In 2015, the Agency conducted an advisory mission to Kuwait on medical aspects of EPR, in cooperation with the World Health Organization. It also conducted five EPREV missions, to Ghana, Jamaica, Kenya, Nigeria and the United Arab Emirates, and two EPREV preparatory missions, to Ghana and Hungary.

In September, the Agency launched the Emergency Preparedness and Response Information Management System (EPRIMS). This new system provides Member States with a comprehensive tool for conducting systematic self-assessments of emergency arrangements based on the most recent Agency safety standards. EPRIMS is expected to contribute to the global harmonization of EPR and to provide the Agency with a valuable source of credible information during emergencies.

In October, over 420 participants from 82 Member States and 18 international organizations attended the International Conference on Global Emergency Preparedness and Response, held at the Agency's Headquarters in Vienna. The conference covered topics such as international cooperation, communication, past emergencies, and education and training, in order to share knowledge and strengthen national systems. Experts in EPR discussed challenges and identified key priorities for further improving readiness to respond to nuclear and radiological emergencies.

"The Agency conducted over 30 training events in 2015, covering all aspects of EPR for nuclear and radiological emergencies."

Capacity Building in Member States

The Agency conducted over 30 training events in 2015, covering all aspects of EPR for nuclear and radiological emergencies. This included a Workshop on Hazard Assessment and Protection Strategy for Radiation Emergencies, held in Malaysia in October, with 24 participants from 16 countries. The Agency also organized a Workshop on Designing Effective National Off-site Emergency Centres for Nuclear or Radiological Emergencies. The workshop, held in December in Daejeon, Republic of Korea, was attended by 15 participants from 8 Asian Nuclear Safety Network countries (Indonesia, Japan, Kazakhstan, the Republic of Korea, Malaysia, the Philippines, Thailand and Viet Nam).

The Agency also established the School of Radiation Emergency Management. The School offers comprehensive instruction in the basic principles of EPR for radiation emergencies, based on the current Agency safety standards and guidelines. A pilot was held in September at the Abdus Salam International Centre for Theoretical Physics, in Trieste, Italy, with 27 participants from 17 Member States. A School was then held in November at the Institute of Radiation Protection and Dosimetry of the National Nuclear Energy Commission (CNEN), in Rio de Janeiro, Brazil, with 30 participants from 16 Member States (Fig. 3). Both events were implemented within the framework of technical cooperation projects. The Agency plans to make the School a regular event at regional EPR capacity building centres.

FIG. 3. Participants in the School of Radiation Emergency Management held in November at the CNEN's Institute of Radiation Protection and Dosimetry in Rio de Janeiro, Brazil.

In 2015, the Agency conducted 15 expert missions to Member States in Asia, Europe and Latin America on subjects ranging from supporting the establishment of radiation monitoring networks to assisting the national hazard assessment process. The missions were designed to help Member States enhance their national emergency arrangements. The Agency also initiated a project, in coordination with the European Union, to enhance emergency arrangements in member States of the Association of Southeast Asian Nations in order to build upon and optimize existing regional EPR capabilities, including the sharing of radiation monitoring data through IRMIS.

Inter-Agency Coordination

The Inter-Agency Committee on Radiological and Nuclear Emergencies (IACRNE), a mechanism facilitating coordinated preparedness and response actions in the case of nuclear and radiological emergencies, held its regular meeting in November. The Committee initiated proposals for the 2016 edition of the Joint Radiation Emergency Management Plan of the International Organizations (JPLAN), endorsed consolidated proposals for its work plan and granted the status of participating organization to the International Labour Organization. An IACRNE task group composed of representatives of the Agency, the International Civil Aviation Organization and the World Meteorological Organization was established to develop a Significant Meteorological Information (SIGMET) advisory system for cases where radioactive material has been released into the atmosphere.

Safety of Nuclear Installations

Objective

To continuously improve the safety of nuclear installations during site evaluation, design, construction and operation through the availability of set safety standards and their application. To support Member States in developing the appropriate safety infrastructure. To assist adherence to and implementation of the Convention on Nuclear Safety and the Code of Conduct on the Safety of Research Reactors and to strengthen international cooperation.

Safety Standards

The site selection process can have a significant impact on the cost, safety and public acceptance of a nuclear installation over its operating lifetime. To provide guidance on the process, the Agency published *Site Survey and Site Selection for Nuclear Installations* (IAEA Safety Standards Series No. SSG-35), addressing all safety aspects to be considered during selection and evaluation of a suitable site. This Safety Guide supplements and provides recommendations on meeting the requirements for nuclear installations established in *Site Evaluation for Nuclear Installations* (IAEA Safety Standards Series No. NS-R-3 (Rev. 1)). In addition, the Agency published *Instrumentation and Control Systems and Software Important to Safety for Research Reactors* (IAEA Safety Standard Series No. SSG-37) and *Construction for Nuclear Installations* (IAEA Safety Standards Series No. SSG-38). These publications reflect current international good practices on important topics for nuclear safety.

Nuclear Safety Infrastructure

"In 2015, the Agency carried out eight initial IRRS missions…and four IRRS follow-up missions"

During the year, the Agency continued to assist Member States in strengthening their governmental, legal and regulatory framework through its Integrated Regulatory Review Service (IRRS). In 2015, the Agency carried out eight initial IRRS missions — to Armenia, Croatia, Hungary, India, Indonesia, Ireland, Malta and the United Republic of Tanzania — and four IRRS follow-up missions — to Finland, Slovakia, Switzerland and the United Arab Emirates. The IRRS missions highlighted the challenges faced by many Member States regarding the legal framework needed for regulatory activities, in particular the lack of specific legal provisions necessary for discharging regulatory responsibilities. The mission results also pointed to challenges concerning core functions of the regulatory body related to the development of regulations and guidelines, and the authorization, formalization and implementation of inspection programmes.

In April, the Agency released a revised version of the Self-Assessment of Regulatory Infrastructure for Safety (SARIS) tool. SARIS is a self-assessment tool used by Member States during preparation for an IRRS mission to document, in an objective manner, the

degree of compliance with the relevant Agency safety standards. The new version includes updated question sets relating to the governmental, legal and regulatory framework for safety, based on the recent revisions to *Governmental, Legal and Regulatory Framework for Safety* (IAEA Safety Standards Series No. GSR Part 1).

The Agency conducted a course for 40 experts at the United States Nuclear Regulatory Commission, in Washington, DC, to expand the pool of experts needed to carry out the IRRS programme. The course provided training in carrying out radiation safety reviews within IRRS missions.

Assessing and addressing the competency needs of regulatory bodies in countries with emerging or expanding nuclear power programmes continue to be an important Agency priority. Throughout the year, the Agency promoted knowledge sharing through regional, thematic networks in the areas of governmental, legal and regulatory infrastructure for safety; leadership and management for safety; communication; and regulatory safety culture. It also provided training to over 600 participants from 40 Member States in some thirty workshops and training courses on regulatory topics. Among these were national and regional workshops supporting the establishment of safety infrastructure by Member States embarking on a new nuclear power programme, held in Belarus in April and November, Thailand in March and October, and Turkey in May. In particular, the Workshop on the Challenges Faced by Newcomer Countries Regarding the Establishment of an Effective National Safety Infrastructure, held in May in Turkey, provided an opportunity for Member States embarking on nuclear power programmes to discuss the challenges they face and how these might be addressed through Agency assistance. This was the second such meeting organized by the Agency, at the request of Member States, to provide a forum for discussion of the challenges of establishing and maintaining effective and independent regulatory bodies.

"[The Agency] provided training to over 600 participants from 40 Member States in some thirty workshops and training courses on regulatory topics."

The Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO) completed a three year joint project with the Agency intended to strengthen regional regulatory capacity building. This project was developed in line with *Managing Regulatory Body Competence* (Safety Report Series No. 79) and *Methodology for the Systematic Assessment of the Regulatory Competence Needs (SARCoN) for Regulatory Bodies of Nuclear Installations* (IAEA-TECDOC-1757).

Convention on Nuclear Safety

At the Sixth Review Meeting of the Contracting Parties to the Convention on Nuclear Safety (CNS), held in 2014, Contracting Parties decided by a two-thirds majority to submit a proposal by Switzerland to amend Article 18 of the CNS to a Diplomatic Conference to be convened within one year. The proposed amendment addressed the design and construction of both existing and new nuclear power plants. On 9 February 2015, the Diplomatic Conference was convened at the Agency's Headquarters in Vienna and was attended by 71 Contracting Parties. The Conference thoroughly considered the Swiss proposal and concluded that it would not be possible to reach consensus on the proposed amendment. Instead, in order to achieve the same objective as the proposed amendment, the Contracting Parties unanimously adopted the Vienna Declaration on Nuclear Safety,[1] which includes "principles to guide them, as appropriate, in the implementation of the objective of the CNS to prevent accidents with radiological consequences and mitigate such consequences should they occur".

The Organizational Meeting to prepare for the Seventh Review Meeting of Contracting Parties to the CNS took place in October in Vienna. The meeting was attended by

1 Available at: *https://www.iaea.org/sites/default/files/infcirc872.pdf*

65 Contracting Parties, and the Nuclear Energy Agency of the Organization for Economic Co-operation and Development (OECD/NEA) as an observer. The Contracting Parties, inter alia, elected the officers for the Seventh Review Meeting, to be held in 2017, and established country groups. They also discussed the preparation and the content of the National Reports for the upcoming Review Meeting.

Safety Assessment of Nuclear Installations

The Agency continued to offer a wide range of safety assessment related services. During the year, it carried out a follow-up Safety Assessment Advisory Programme (SAAP) mission to Malaysia and conducted three technical safety reviews of Chinese reactor designs (ACP1000, ACP100 and CAP1400). The Agency carried out 25 workshops and training courses to support countries embarking on a nuclear power programme, providing training to over 300 participants through its Safety Assessment Education and Training (SAET) Programme. The activities focused on topics ranging from essential knowledge to the practical application of safety analysis software. In October, the Agency, in cooperation with the Abdus Salam International Centre for Theoretical Physics, conducted a two week essential knowledge training course in Trieste, Italy, attended by 44 participants from 17 Member States. It also provided training through two walkdowns of the never-commissioned Zwentendorf nuclear power plant near Vienna (Fig. 1).

"The Agency carried out 25 workshops and training courses to support countries embarking on a nuclear power programme, providing training to over 300 participants through its Safety Assessment Education and Training (SAET) Programme."

In February, the Agency, in coordination with the OECD/NEA, held an 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 over 150 experts from 38 Member States and five international organizations, representing nuclear power plant operating organizations, research institutes, nuclear reactor vendors, nuclear regulatory bodies, and technical and scientific support organizations. It provided a forum for experts from Member States and international organizations to exchange information and experience related to research and development undertaken in the light of the Fukushima Daiichi accident. The experts discussed the R&D strategies in Member States following the Fukushima Daiichi accident, including those associated with severe accident analysis, technologies to prevent or mitigate severe accidents, emergency preparedness and response, and post-accident recovery.

FIG. 1. Participants in a walkdown of the never-commissioned Zwentendorf nuclear power plant in Austria, one of two such training exercises held by the Agency in 2015.

In October, the Agency held two Technical Meetings on safety assessment of nuclear installations: a Technical Meeting on the Design and Construction of Containment Structures and Systems for New Nuclear Power Plants, held in Vienna; and a Technical Meeting on Topical Issues of Severe Accident Analysis and Management for Nuclear Power Plants, held in Moscow, Russian Federation. In December, it hosted a Consultancy Meeting on the Assessment of Defence in Depth for Nuclear Power Plants at its Headquarters in Vienna, aimed at identifying methods for assessing defence in depth and ways to strengthen it.

Site Safety and Design against Internal and External Hazards

The Agency's Site and External Events Design (SEED) review service provides guidance on evaluating potential sites for nuclear power plants to ascertain site specific external and internal hazards and the proposed plant's ability to safely withstand them. In 2015, the Agency carried out four SEED missions, to Bangladesh, Jordan, Thailand and Viet Nam, and one preparatory SEED mission to Indonesia. Such missions assist Member States by providing an independent review of each of the different stages of site selection, site evaluation and design of structures, systems and components.

The Agency also delivered four workshops and three training courses on topics related to site safety. These training events were aimed at supporting those States embarking on or expanding a nuclear power programme in acquiring the necessary competence for nuclear site and design safety. In total, around 130 participants from 7 Member States took part.

In June, the Agency issued two publications on seismic safety: *Ground Motion Simulation Based on Fault Rupture Modelling for Seismic Hazard Assessment in Site Evaluation for Nuclear Installations* (Safety Reports Series No. 85) and *The Contribution of Palaeoseismology to Seismic Hazard Assessment in Site Evaluation for Nuclear Installation* (IAEA-TECDOC-1767).

Operational Safety and Experience Feedback

In 2015, the Agency conducted six Operational Safety Review Team (OSART) missions — to Bruce B (Canada), Dampierre (France), Kashiwazaki-Kariwa Units 6 and 7 (Japan), Chashma 1 (Pakistan), Novovoronezh (Russian Federation) and Sizewell B (United Kingdom) — as well as two OSART follow-up missions — to Chooz B (France) and Clinton (United States of America). Together with reviewers from Member States, the Agency conducted a Corporate OSART follow-up mission to the ČEZ Group in the Czech Republic, the third such mission carried out to date. Corporate OSART missions are designed to review corporate functions (e.g. corporate management, human resources, communication, independent oversight) that have an impact on safety at nuclear power plants owned or operated by utilities.

The Agency conducted four Safety Aspects of Long Term Operation (SALTO) missions during the year — to Tihange (Belgium), Qinshan (China), Laguna Verde (Mexico) and Koeberg (South Africa). It also completed phase two of the International Generic Ageing Lessons Learned (IGALL) project for nuclear power plants. The results of the second phase of the IGALL project were approved by the IGALL Steering Committee in November and subsequently presented at a Technical Meeting in Vienna in November, after which the third phase of the IGALL project was launched. In May, the Agency published *Ageing Management for Nuclear Power Plants: International Generic Ageing Lessons Learned (IGALL)* (Safety Reports Series No. 82).

Safety of Research Reactor and Fuel Cycle Facilities

In 2015, the Agency carried out a number of activities to support enhanced research reactor safety that were attended by experts from more than 60 Member States. These included: the International Conference on Research Reactors: Safe Management and Effective Utilization, held in Vienna in November; regional meetings on the application of the Code of Conduct on the Safety of Research Reactors, held in Asia and Europe; Technical Meetings on research reactor ageing management, modernization and modifications, and on the safety performance indicators of research reactors under project and supply agreements; and an international workshop on managing the interface between safety and security. Among the safety issues of regional concern were regulatory inspection programmes (Africa and Asia); infrastructure for new research reactor projects (Africa and Arab regions); and safety reassessment in the light of the Fukushima Daiichi accident (Africa).

Safety missions were undertaken to research reactors in China, the Islamic Republic of Iran, Italy, Jamaica, Peru, Portugal, Slovenia, Turkey and Uzbekistan. The missions provided guidance on, and recommendations for improvements concerning, safety of utilization programmes, safety assessment, ageing management, periodic safety review, radiation protection and reactor fuel conversion from high enriched uranium to low enriched uranium. The Agency also conducted a mission to Jordan on the commissioning of that country's first research reactor, as well as missions to the Sudan, Tunisia, the United Republic of Tanzania and Viet Nam on the infrastructure of research reactor projects in those countries.

"In May the Agency held a Technical Meeting on Safety Analysis and Safety Documents for Fuel Cycle Facilities that was attended by 430 participants from 23 Member States"

In March, the Agency held a meeting in Sofia, Bulgaria, on incident reporting to support the dissemination of operating experience and improve networking. The meeting was attended by 43 participants from 33 Member States. Also that month, it issued *Operating Experience from Events Reported to the IAEA Incident Reporting System for Research Reactors* (IAEA-TECDOC-1762) on the feedback from events of safety significance at research reactors.

In May the Agency held a Technical Meeting on Safety Analysis and Safety Documents for Fuel Cycle Facilities that was attended by 430 participants from 23 Member States, and in September, it held a Workshop on Ageing Management for Fuel Cycle Facilities, with 18 participants from 17 Member States. In November, the Agency conducted a follow-up Safety Evaluation of Fuel Cycle Facilities during Operation (SEDO) mission to Romania's Nuclear Fuel Plant to assess the progress made on implementing the recommendations from the previous SEDO mission.

Radiation and Transport Safety

Objective

To achieve global harmonization of the development and application of the Agency's safety standards in this area, and to increase the safety of radiation sources and thereby raise the levels of protection of people, including Agency staff, against the harmful effects of radiation.

Protection of the Public

In 2015, the Agency concluded a three year project on radiation monitoring and remediation carried out in cooperation with Fukushima Prefecture, in which it provided assistance on questions related to remediation of areas affected by the accident at the Fukushima Daiichi nuclear power plant, safe management of waste collected during remediation activities and radiation monitoring. As part of these activities, the Agency provided support and assistance to projects carried out by Fukushima Prefecture related to treatment of remediation waste in municipal incinerators, remediation activities in rivers and lakes, and radiation protection issues in forests. A two year extension of the project has been approved.

Radiation Protection of Patients

In November, the Agency held a training course in Vienna on implementing guidance on radiation protection and safety in medical uses of ionizing radiation. The course presented the requirements established in *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards* (IAEA Safety Standards Series No. GSR Part 3) for the safe use of ionizing radiation in medicine, and provided recommendations and guidance on meeting these requirements in medical facilities (Fig. 1). More than 50 representatives of 27 Member States and 3 international organizations participated in the training. The Agency also held two Technical Meetings on reducing unnecessary medical exposures, attended by more than 100 participants from all regions.

FIG. 1. Planning the use of ionizing radiation for cancer treatment in a radiotherapy clinic in Zimbabwe. The Agency provided training in meeting requirements for the safe use of ionizing radiation in medical facilities to more than 50 medical professionals in 2015.

Occupational Radiation Protection

The use of nuclear and radiation technologies continues to increase in many sectors around the world. In this context, the Agency released a new ISEMIR-IR (Information System on Occupational Exposure in Medicine, Industry and Research — Industrial Radiography) tool. ISEMIR-IR is a web based system that supports the exchange of experience, lessons learned and best practices aimed at reducing occupational doses in the area of industrial radiography.

The Agency's Occupational Radiation Protection Appraisal Service (ORPAS) provides Member States, on request, with an independent assessment and evaluation of their national occupational radiation protection programme. Such evaluations are useful in maintaining or enhancing programme effectiveness and highlight potential areas for improvement. Member States also benefit from the information on best practices available through ORPAS. In 2015, the Agency conducted ORPAS missions to Ecuador and the United Arab Emirates, and a preparatory ORPAS mission to Ghana.

During the year, the Agency published two publications on occupational radiation protection: *Naturally Occurring Radioactive Material (NORM VII)*, the proceedings of the seventh international symposium on naturally occurring radioactive material organized by the Agency; and *Radiation Protection of Itinerant Workers* (Safety Reports Series No. 84), on the radiation protection issues associated with the use of itinerant workers, and the managerial and practical arrangements necessary to ensure that radiation doses are adequately controlled.

Regulatory Infrastructure

An increasing number of Member States without nuclear installations are making use of the Agency's Integrated Regulatory Review Service (IRRS). In 2015, IRRS missions were conducted to six Member States without operating nuclear power plants: Croatia, Indonesia, Ireland, Malta, the United Republic of Tanzania and the United Arab Emirates. The effectiveness of the regulatory infrastructure for radiation, transport and waste safety was also reviewed in IRRS missions to five Member States with operating nuclear power plants: Armenia, Finland, Hungary, Slovakia and Switzerland. Advisory missions on strengthening national regulatory infrastructure for radiation safety were conducted to Bosnia and Herzegovina, the Lao People's Democratic Republic, Papua New Guinea and Uruguay. In addition, the Agency organized two workshops to train staff of regulatory bodies to serve as IRRS reviewers in radiation safety.

Transport Safety

In 2015, the Agency published the *Schedules of Provisions of the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition)* (IAEA Safety Standards Series No. SSG-33). This publication provides information on determining the correct package type and the appropriate operational and administrative requirements to be applied when shipping radioactive material.

The Agency conducted 12 regional capacity building events in 2015 aimed at enhancing transport safety in Member States in Africa, Asia, Latin America, the Mediterranean, Europe and the Pacific Islands. The activities drew over 250 participants from over 80 Member States, who participated in practical exercises (Fig. 2) and worked collaboratively to define regional actions to improve transport safety.

"The Agency conducted 12 regional capacity building events in 2015 aimed at enhancing transport safety in Member States in Africa, Asia, Latin America, the Mediterranean, Europe and the Pacific Islands."

FIG. 2. Participants in a Regional Meeting on Transport Safety in the Pacific Islands take part in a practical exercise on responding to a transport incident.

Education and Training in Radiation Safety

The Agency encourages Member States to establish national strategies for education and training in radiation, transport and waste safety. In this connection, a consultative meeting was held in Vienna to enable policy and decision makers to follow up on initiatives taken by Member States to establish national education and training strategies. The meeting, attended by representatives of some fifty Member States, highlighted the need for sustainability when building competence in radiation protection and safety, in accordance with the Agency's Strategic Approach to Education and Training in Radiation, Transport and Waste Safety (2011–2020). During the year, three Education and Training Appraisal (EduTA) missions were conducted, to Greece, Israel and Lithuania.

In 2015, the Agency held seven Postgraduate Educational Courses in Radiation Protection and the Safety of Radiation Sources, in Algeria, Argentina, Ghana (two separate courses), Greece, Malaysia and Morocco. Regional train the trainers courses for radiation protection officers were held in Morocco, Namibia, Portugal and the United Arab Emirates.

Under a regional project entitled 'Strengthening Education and Training Infrastructure, and Building Competence in Radiation Safety', the Agency developed a train the trainers course for radiation protection officers. The first course was held in Portugal in June, for Member States in Europe, with 32 participants from 22 Member States in the region taking part. The training aimed at supporting implementation of national strategies for education and training in radiation, transport and waste safety, and at maintaining and expanding competencies to facilitate implementation of national education and training programmes. Participants also received additional training to act as trainers of radiation protection officers in their own countries.

"In 2015, the Agency held seven Postgraduate Educational Courses in Radiation Protection and the Safety of Radiation Sources"

Radiation Safety Information Management System

The web based Radiation Safety Information Management System (RASIMS) platform is a tool that enables Member States to monitor the status and level of implementation of their radiation safety infrastructure in line with the Agency's safety standards. In 2015, the information provided through this collaborative platform was used in the evaluation of requests for procurement of radiation sources for Member States. It was also considered prior to the submission of technical cooperation project proposals for approval by the Agency's Policy-Making Organs. During the year, 18 Member States appointed RASIMS National Coordinators and 100 Member States accessed RASIMS to update their radiation safety profiles.

Management of Radioactive Waste

Objective

To achieve harmonization in policies and standards governing waste safety and public and environmental protection, together with provisions for their application, including sound technologies and good practices.

Waste and Environmental Safety

Radioactive waste and spent fuel management

Remediation activities undertaken after nuclear accidents may generate large quantities of waste with low levels of radionuclides. Member States have requested a simple methodology to evaluate disposal options for material with residual amounts of radionuclides. In response to these requests, the Agency launched a new project aimed at deriving specific clearance levels for disposal of waste on landfill sites. The project was launched in June and is scheduled to run for two years.

"In response to [Member State] requests, the Agency launched a new project aimed at deriving specific clearance levels for disposal of waste on landfill sites."

In February, the Agency conducted the third International Peer Review of the Mid-and-Long-Term Roadmap towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station Units 1–4. The mission involved 15 international experts, who provided an independent review of the planning and implementation of the decommissioning of the Fukushima Daiichi nuclear power plant based on Agency safety standards and other relevant good practices (Fig. 1). The team of experts found that the situation on the site had improved since the last Agency mission, conducted in 2013. Since that time, several important tasks had been accomplished: the fuel had been removed from Unit 4; the systems for treating contaminated water had been expanded and improved; the underground water bypass was in operation; and further clean-up of the site debris had resulted in a reduction in the radiological dose rate. A comprehensive seawater monitoring programme, including control by independent laboratories, had also been introduced. In this connection, the IAEA Environment Laboratories in Monaco cooperated with Japanese and other international marine laboratories in conducting an interlaboratory comparison exercise for seawater analysis to ensure the quality and consistency of monitoring results.

FIG. 1. A team of Agency experts during a decommissioning review at Unit 4 of the Fukushima Daiichi nuclear power plant.

Assessment and management of environmental releases

In 2015, the Agency conducted a peer review of the environmental impact assessment prepared for the Baltic nuclear power plant in Kaliningrad, Russian Federation. The review team, consisting of four international experts, compared the assessment against the requirements for radiation protection established in the Agency's safety standards.

In 2012, the Agency established the MODARIA (Modelling and Data for Radiological Impact Assessments) Programme to improve capabilities in the field of environmental radiation dose assessment by acquiring improved data for model testing; testing and comparing models; reaching consensus on modelling philosophies, approaches and parameter values; developing improved methods for assessment; and exchanging information. Work on the MODARIA Programme was completed in 2015. The Programme's achievements were reviewed at a workshop held in November at the Agency's Headquarters in Vienna that was attended by over 150 experts — including regulators, operators and scientists — from over 40 countries. A follow-up project is scheduled to begin in 2016.

Decommissioning and remediation safety

In January, the Agency established the International Project on Decommissioning and Remediation of Damaged Nuclear Facilities (DAROD). The project was launched at a Technical Meeting held in Vienna, with the participation of 35 experts from 19 Member States, and is aimed at sharing and learning from the experience gained during decommissioning and remediation of damaged nuclear facilities and legacy sites. During the year, the Agency developed training materials on remediation of legacy uranium production sites, including three summary documents and 140 presentations covering both short term and long term aspects of remediation. To avoid future legacy issues, the Agency also developed related materials on safety aspects of new uranium exploration and production activities.

Joint Convention Meeting

The Fifth Review Meeting of the Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was held in May at the Agency's Headquarters in Vienna. Sixty-one of the 69 Contracting Parties participated in the Review Meeting. The Contracting Parties discussed, in particular, the progress made since the Fourth Review Meeting with regard to the management of disused sealed sources; the safety implications of very long storage periods and delayed disposal of spent fuel and radioactive waste; and international cooperation in finding solutions for the long term management and disposal of different types of radioactive waste and spent fuel.

The participants also identified a number of overarching issues, including: staffing, staff development, funding and other human resources matters; maintaining and increasing public involvement and engagement on waste management to foster public confidence and acceptance; managing disused sealed sources; and developing and implementing a holistic and sustainable management strategy for radioactive waste and spent fuel at an early stage.

The meeting included a topical session on progress on lessons learned from the Fukushima Daiichi accident. The discussions focused on spent fuel and radioactive waste management, and on related issues such as the relevance of the Fukushima Daiichi accident for Contracting Parties without a nuclear power programme, the management of large volumes of accident waste and lessons learned from decontamination following a radiological accident.

The Contracting Parties decided on a number of actions with a view to, inter alia, encouraging adherence to the Joint Convention and active participation in the review process, and to increasing the effectiveness of the review process for Contracting Parties without a nuclear power programme. An Extraordinary Meeting to address some of these issues is scheduled for 2017, prior to the Organizational Meeting for the Sixth Review Meeting.

Nuclear Security

Objective

To contribute to global efforts to achieve effective nuclear security, by establishing current, comprehensive and complete global nuclear security guidance and providing for its application through peer reviews and advisory services and capacity building, including education and training. To assist in adherence to and implementation of nuclear security related international instruments, and to strengthen the international cooperation and coordination of assistance in a way that underpins the use of nuclear energy and applications. To lead and enhance international cooperation in nuclear security, in response to General Conference resolutions and Board of Governors directions.

The need for continued efforts to improve nuclear security worldwide was clearly demonstrated during the year by General Conference resolutions and requests for assistance. The Agency continued to assist States, upon request, in making their national nuclear security regimes more robust, sustainable and effective. In implementing the Nuclear Security Plan 2014–2017, it supported States in the areas of needs assessment, information security and cybersecurity; external coordination; the development of a global nuclear security framework; coordinated research projects (CRPs); self-assessments and peer reviews; human resource development; and risk reduction and security improvement. Physical protection remained a key focus of activities implemented under the Plan. Throughout the year, in response to Member State requests, the Agency focused increased attention on promoting the nuclear security framework globally, and on developing nuclear security guidance and providing for its use and application, including through CRPs.

Promotion of the Nuclear Security Framework

The Agency assists in the development and promotion of a comprehensive and global nuclear security framework. Its activities in this area in 2015 contributed to increased awareness of and support for relevant legally binding and non-binding international instruments. The Agency focused in particular on the entry into force of the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM).

During the year, Kyrgyzstan and San Marino acceded to the CPPNM, and seven States — Botswana, Iceland, Italy, Morocco, San Marino, Turkey and the United States of America — joined its 2005 Amendment.

In December, the Agency organized the first Technical Meeting of Points of Contact and Central Authorities of States Parties to the CPPNM, held in Vienna and attended by more than 100 participants from 70 States. The meeting was aimed at improving the ability of States Parties to the CPPNM to meet their obligations under Article 5 of the Convention. This Article requires States Parties to make known to each other their Points of Contact and Central Authorities having responsibility for physical protection as well

as the provisions of the Convention relating to information exchange. Participants also discussed the responsibilities and the legal obligations of the Points of Contact and Central Authorities, and mechanisms to meet the enhanced Point of Contact responsibilities when the Amendment to the CPPNM enters into force.

Nuclear Security Guidance

In response to Member State requests, the Agency develops comprehensive guidance on nuclear security, with the active involvement of experts from Member States, which is issued in the IAEA Nuclear Security Series. In 2015 the Nuclear Security Guidance Committee began its second term. The Committee was established by the Director General in 2012 to increase Member State input into the IAEA Nuclear Security Series. To date, 65 Member States have nominated representatives to the Committee.

During the year, the Agency published four Implementing Guides: *Security of Nuclear Information* (IAEA Nuclear Security Series No. 23-G); *Risk Informed Approach for Nuclear Security Measures for Nuclear and Other Radioactive Material out of Regulatory Control* (IAEA Nuclear Security Series No. 24-G), jointly sponsored by the International Criminal Police Organization – INTERPOL; *Use of Nuclear Material Accounting and Control for Nuclear Security Purposes at Facilities* (IAEA Nuclear Security Series No. 25-G); and *Security of Nuclear Material in Transport* (IAEA Nuclear Security Series No. 26-G). In addition, the Agency published *Nuclear Forensics in Support of Investigations* (IAEA Nuclear Security Series No. 2-G (Rev. 1)), a revision of an earlier Agency publication on the topic. At the end of 2015, there were 25 publications in the IAEA Nuclear Security Series.

Capacity Building in Nuclear Security

Member States continued to benefit from education and training opportunities developed by the Agency to further strengthen national nuclear security regimes and nuclear security infrastructure. The Agency conducted a total of 108 security related training courses and workshops (23 international or regional, 85 national) in 2015, providing training to more than 2300 participants.

"The Agency conducted a total of 108 security related training courses and workshops…in 2015, providing training to more than 2300 participants."

Among the Agency workshops most frequently requested by Member States are the national workshops on the guidance contained in *Development, Use and Maintenance of the Design Basis Threat* (IAEA Nuclear Security Series No. 10). In the course of the year, the Agency delivered nine such workshops, bringing to 68 the total number delivered since 2009.

The fifth Joint IAEA–ICTP International School on Nuclear Security took place at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy, in April and May, providing a comprehensive introduction to the field of nuclear security. The course was attended by 46 young nuclear professionals from regulatory bodies, universities, research institutions, government ministries, operators using radioactive sources and law enforcement agencies in 43 Member States.

The Agency continued to coordinate efforts in education and training with its respective networks. The fourth annual Meeting of the International Network for Nuclear Security Training and Support Centres (NSSC Network) was held at the Agency's Headquarters in February. The meeting was attended by 65 participants from 47 Member States and the European Union, the Center for Strategic and International Studies, and the World Institute of Nuclear Security.

In August, the Agency hosted the annual meeting of the International Nuclear Security Education Network (INSEN). The meeting was attended by 97 participants from 37 Member States.

To enhance national capacities to detect material out of regulatory control, the Agency donates detection instruments to States. In the course of 2015, the Agency donated some 780 detection instruments, including four portal monitors.

International Conference on Computer Security in a Nuclear World

Secure computer systems are essential to nuclear security, and Member States often request support in developing comprehensive and resilient computer and information security systems. To address this important issue, in June the Agency hosted the International Conference on Computer Security in a Nuclear World: Expert Discussion and Exchange at its Headquarters in Vienna. Organized in cooperation with the International Criminal Police Organization – INTERPOL, the International Telecommunication Union, the United Nations Interregional Crime and Justice Research Institute, and the International Electrotechnical Commission, the conference drew over 700 participants from 92 Member States and 17 organizations. Among the topics discussed were computer security threats in the context of nuclear security (Fig. 1); computer security and system designs; coordination of computer security in a nuclear security regime; nuclear security regulatory approaches; computer security programmes; management of computer security; and computer security culture and capacity. The conference provided a global forum for competent authorities, operators, system and security vendors, and other stakeholders to share information and discuss computer security as it relates to nuclear security.

Improving the Advisory Services and Peer Review Process

"The Agency developed and organized a workshop to increase the pool of experts available for IPPAS mission."

In 2015, the Agency began developing new guidelines for International Nuclear Security Advisory Service (INSServ) missions. The new INSServ guidelines will ensure that INSServ missions are compatible with, and complementary to, International Physical Protection Advisory Service (IPPAS) missions, which assess a State's nuclear security regime in relation to regulated activities for nuclear and other radioactive material, associated facilities and associated activities. The INSServ missions will be a peer review and advisory service for a State's national nuclear security regime as it relates to nuclear and other radioactive material out of regulatory control. The Agency developed and organized a workshop to increase the pool of experts available for IPPAS missions. The workshop provided an overview of the IPPAS process, the objectives and scope of IPPAS missions, the roles and responsibilities of IPPAS team members, the IPPAS Guidelines, and the IPPAS mission report.

During the year, the Agency developed an IPPAS database of all good practices from IPPAS mission reports. More than 70% of the host countries have agreed to share this database with all States through the Nuclear Security Information Portal. The IPPAS database does not disclose the country or the facility where the good practice information comes from.

To date, a total of 76 INSServ missions had been conducted to 64 Member States, and a total of 69 IPPAS missions had been conducted to 43 Member States, one non–Member State and the Terrestrial Environment Laboratory in Seibersdorf.

Incident and Trafficking Database

During 2015, Cambodia, Guatemala and Honduras joined the programme. In the course of the year, States confirmed 226 incidents to the Incident and Trafficking Database (ITDB). While most of these incidents involved radioactive sources and radioactively contaminated material, States confirmed 26 incidents involving nuclear material. The triennial meeting

FIG. 1. A demonstration of a hypothetical cyberattack on both a competent authority and a nuclear power plant given at the International Conference on Computer Security in a Nuclear World: Expert Discussion and Exchange, held in June.

of Points of Contacts to the ITDB was held in July in Vienna, and was attended by representatives from 89 States as well as the International Criminal Police Organization – INTERPOL. The main outcome of the meeting was agreement on measures for improving reporting and communication, including the approval of an ITDB conceptual framework, a revised system of classifying incidents and updated reporting guidelines. This agreement will improve the quality of incident reports submitted by States.

Nuclear Security Fund

In the course of 2015, financial pledges to the Nuclear Security Fund were accepted by the Agency in the amount of €30.4 million. The €30.4 million included financial contributions from Belgium, Canada, China, Estonia, Finland, France, Indonesia, Italy, Japan, Kazakhstan, the Republic of Korea, New Zealand, Norway, the Russian Federation, Spain, the Sudan, Sweden, the United Kingdom, the United States of America and Zimbabwe. In-kind contributions of €180 148 were also received.

Nuclear Verification

Nuclear Verification[1,2]

Objective

To deter the proliferation of nuclear weapons by the early detection of the misuse of nuclear material or technology, and by providing credible assurances that States are honouring their safeguards obligations. To contribute to nuclear arms control and disarmament by responding to States' requests for verification and other technical assistance associated with related agreements and arrangements. To continually improve and optimize operations and capabilities to effectively carry out the Agency's verification mission.

Implementation of Safeguards in 2015

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.

With regard to States with comprehensive safeguards agreements (CSAs), the Agency seeks to conclude that all nuclear material has remained in peaceful activities. To draw such a conclusion, the Agency must ascertain, firstly, that there are no indications of diversion of declared nuclear material from peaceful activities (including no misuse of declared facilities or other declared locations to produce undeclared nuclear material) and, secondly, that there are no indications of undeclared nuclear material or activities in the State as a whole.

To ascertain that there are no indications of undeclared nuclear material or activities in a State, and ultimately to be able to draw the broader conclusion that *all* nuclear material has remained in peaceful activities in that State, the Agency assesses the results of its verification and evaluation activities under the State's CSA and additional protocol (AP). Thus, for the Agency to draw such a broader conclusion, both a CSA and an AP must be in force for the State, and the Agency must have completed all necessary verification and evaluation activities and found no indication that, in its judgement, would give rise to a proliferation concern.

For a State that has a CSA but not an AP in force, as the Agency does not have sufficient tools to provide credible assurances regarding the absence of undeclared nuclear material

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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.

and activities in the State, it draws a conclusion only with respect to whether *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 2015 integrated safeguards were implemented for 54 States[3,4].

In 2015, safeguards were applied for 181 States[5,6] with safeguards agreements in force with the Agency. Of the 121 States that had both a CSA and an AP in force, the Agency concluded that *all* nuclear material remained in peaceful activities in 67 States[7]; for 54 States, as the necessary evaluation regarding the absence of undeclared nuclear material and activities for each of these States remained ongoing, the Agency was unable to draw the same conclusion. For these 54 States, and for the 52 States with a CSA but with no AP in force, the Agency concluded only that *declared* nuclear material remained in peaceful activities.

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.

As of 31 December 2015, 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 SQPs

The Agency continued to facilitate the conclusion of safeguards agreements and APs (Fig. 1), and the amendment or rescission of small quantities protocols (SQPs)[8]. The status of safeguards agreements and APs as of 31 December 2015 is shown in Table A6 in the Annex

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3 Armenia, Australia, Austria, Bangladesh, Belgium, 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, Republic of Korea, Latvia, Libya, Lithuania, Luxembourg, Madagascar, Mali, Malta, Monaco, Netherlands, Norway, Palau, Peru, Poland, Portugal, Romania, Seychelles, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, The former Yugoslav Republic of Macedonia, Ukraine, Uruguay and Uzbekistan.

4 And Taiwan, China.

5 These 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.

6 And Taiwan, China.

7 And Taiwan, China.

8 Many States with minimal or no nuclear activities have concluded an SQP to their CSA. Under an SQP, the implementation of most of the safeguards procedures in Part II of a CSA is held in abeyance as long as certain criteria are met. In 2005, the Board of Governors took the decision to revise the standardized text of the SQP and change the eligibility criteria for an SQP, making it unavailable to a State with an existing or planned facility and reducing the number of measures held in abeyance (GOV/INF/276/Mod.1 and Corr.1). The Agency initiated exchanges of letters with all States concerned in order to give effect to the revised SQP text and the change in the criteria for an SQP.

to this report. During 2015, one State[9] signed and brought into force a comprehensive safeguards agreement with an SQP and an AP, and one State[10] signed a comprehensive safeguards agreement with an SQP. In addition, two States[11] brought an AP into force. By the end of 2015, safeguards agreements were in force with 182 States and APs were in force with 127 States.

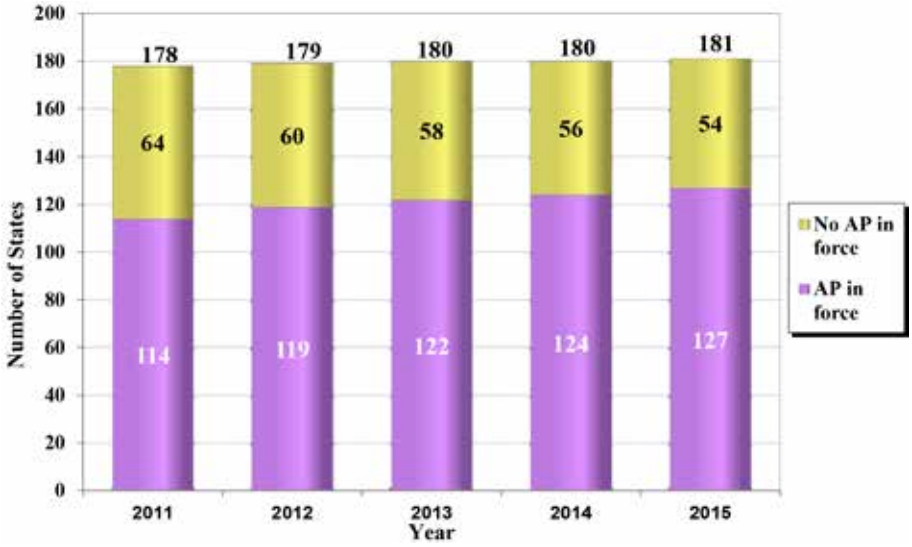

FIG. 1. Number of APs for States with safeguards agreements in force, 2011–2015 (the Democratic People's Republic of Korea is not included).

The Agency continued to implement the *Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols*[12], which was updated in September 2015. The Agency organized regional and sub-regional events for States in Africa (held in Vienna), in Southeast Asia (in Singapore) and in the Caribbean (in Panama City), and a briefing for a number of Permanent Missions, at which the Agency encouraged the participating States to conclude comprehensive safeguards agreements and additional protocols, and to amend their SQPs. Also, a national workshop on safeguards was organized for Mongolia. In addition, the Agency held consultations with representatives from a number of Member and non-Member States in Geneva, New York and Vienna at various times throughout the year.

The Agency continued to communicate with States in order to implement the Board's 2005 decisions regarding SQPs, with a view to rescinding such protocols or amending them to reflect the revised standard text. During 2015, one State[13] amended its operative SQP to reflect the revised standard text and three States[14] rescinded their SQPs. This means that, by the end of 2015, 60 States of some 100 States had accepted the revised SQP text (which was in force for 54 of these States).

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9 Djibouti.

10 Federated States of Micronesia.

11 Cambodia and Liechtenstein.

12 Available at: *https://www.iaea.org/sites/default/files/final_action_plan_1_july_2014_to_30_june_2015.doc.pdf.*

13 Togo.

14 Azerbaijan, Jordan and Tajikistan.

Islamic Republic of Iran (Iran)

During 2015, the Director General submitted four reports to the Board of Governors entitled *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran* (GOV/2015/15, GOV/2015/34, GOV/2015/50 and GOV/2015/65).

In 2015, Iran continued to conduct enrichment related activities, although it did not produce uranium hexafluoride enriched above 5% uranium-235. Iran also continued work on heavy water related projects. However, it neither installed any major components at the IR-40 Reactor nor produced nuclear fuel assemblies for the IR-40 Reactor at the Fuel Manufacturing Plant[15].

On 14 July 2015, the Director General and the Vice-President of Iran and President of the Atomic Energy Organization of Iran, HE Ali Akbar Salehi, signed in Vienna a Road-map for the clarification of past and present outstanding issues regarding Iran's nuclear programme (GOV/INF/2015/14) (Fig. 2). The Road-map identified the necessary activities to be undertaken under the Framework for Cooperation in order to accelerate and strengthen cooperation and dialogue between the Agency and Iran aimed at the resolution, by the end of 2015, of all past and present outstanding issues — as set out in the annex to the Director General's report of November 2011 (GOV/2011/65) — that had not already been resolved by the Agency and Iran.

FIG. 2. IAEA Director General Yukiya Amano and Vice-President of the Islamic Republic of Iran Ali Akbar Salehi signed the Road-map for the clarification of past and present issues regarding Iran's nuclear programme, in Vienna on 14 July 2015.

The activities set out in the Road-map, including technical-expert meetings and the conduct of safeguards activities by the Agency at particular locations in Iran, were

[15] In 2015, Iran was required by relevant binding resolutions of the Board of Governors and the United Nations Security Council to implement the modified Code 3.1 of the Subsidiary Arrangements General Part to its Safeguards Agreement; suspend all enrichment-related and reprocessing activities; and suspend all heavy water-related activities. Security Council resolution 2231 (2015), adopted in July 2015, included terms providing for the termination of the provisions of six Security Council resolutions adopted between 2006 and 2010.

completed on schedule. The implementation of the Road-map facilitated a more substantive engagement between the Agency and Iran.

On 2 December 2015, the Director General provided a report to the Board of Governors on the *Final Assessment on Past and Present Outstanding Issues regarding Iran's Nuclear Programme* (GOV/2015/68). The Agency assessed that a range of activities relevant to the development of a nuclear explosive device had been conducted in Iran prior to the end of 2003 as a coordinated effort, and some activities took place after 2003. The Agency also assessed that these activities had not advanced beyond feasibility and scientific studies, and the acquisition of certain relevant technical competences and capabilities. The Agency had no credible indications of activities in Iran relevant to the development of a nuclear explosive device after 2009 and found no credible indications of the diversion of nuclear material in connection with the possible military dimensions to Iran's nuclear programme.

On 15 December 2015, the Board of Governors adopted resolution GOV/2015/72, in which, inter alia, it noted that all activities in the Road-map had been completed in accordance with the agreed schedule and that this closed its consideration of this item.

Throughout 2015, the Agency continued to undertake monitoring and verification in relation to the nuclear-related measures set out in the Joint Plan of Action agreed between China, France, Germany, the Russian Federation, the United Kingdom, the United States of America (E3+3) and Iran, the aim of which was to reach a "mutually-agreed, long-term comprehensive solution that would ensure Iran's nuclear programme will be exclusively peaceful". The Joint Plan of Action was extended three times, most recently on 30 June 2015, when the E3+3 and Iran requested the Agency, on behalf of the E3/EU+3 and Iran, to continue to undertake the necessary nuclear-related monitoring and verification activities in Iran under the Joint Plan of Action until further notice.

On 14 July 2015, the E3/EU+3 and Iran agreed on a Joint Comprehensive Plan of Action (JCPOA), stating that "the full implementation of this JCPOA will ensure the exclusively peaceful nature of Iran's nuclear programme". In August 2015, the Board of Governors, inter alia, authorized the Director General to implement the necessary verification and monitoring of Iran's nuclear-related commitments as set out in the JCPOA, and report accordingly, for the full duration of those commitments in light of United Nations Security Council resolution 2231 (2015), subject to the availability of funds and consistent with the Agency's standard safeguards practices; and authorized the Agency to consult and exchange information with the Joint Commission, as set out in the Director General's report on *Verification and Monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015)* (GOV/2015/53 and Corr.1 thereto). After Adoption Day, the Agency began conducting preparatory activities related to the verification and monitoring of Iran's nuclear-related commitments under the JCPOA.

In October 2015, Iran informed the Agency pursuant to paragraph 8 of Annex V of the JCPOA that, effective on JCPOA Implementation Day, Iran would provisionally apply the Additional Protocol to its Safeguards Agreement pending its entry into force, and would fully implement the modified Code 3.1 of the Subsidiary Arrangements to its Safeguards Agreement.

While the Agency continued throughout 2015 to verify the non-diversion of declared nuclear material at the nuclear facilities and locations outside facilities declared by Iran under its Safeguards Agreement, the Agency was not in a position 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.

Syrian Arab Republic (Syria)

In September 2015, the Director General submitted a report to the Board of Governors entitled *Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic* (GOV/2015/51) covering relevant developments since the previous report in

September 2014 (GOV/2014/44). 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 2015, the Director General renewed his call on Syria to cooperate fully with the Agency in connection with unresolved issues related to the Dair Alzour site and other locations. Syria has yet to respond to these calls.

In 2015, Syria indicated its readiness to receive Agency inspectors, and to provide support for the purpose of performing a physical inventory verification (PIV) at the Miniature Neutron Source Reactor in Damascus. On 29 September 2015, the Agency — after considering the United Nations Department of Safety and Security's assessment of the prevailing security level in Syria and making additional arrangements to ensure the safe transit of the inspectors — successfully carried out the PIV at the reactor.

On the basis of the evaluation of information provided by Syria, the results of the safeguards verification activities and all relevant information available to it, the Agency found no indication of the diversion of declared nuclear material from peaceful activities. For 2015, the Agency concluded for Syria that declared nuclear material remained in peaceful activities.

Democratic People's Republic of Korea (DPRK)

In August 2015, 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/2015/49–GC(59)/22), which provided an update of developments since the Director General's report of September 2014.

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.

Since April 2009, the Agency has not implemented any measures under the ad hoc monitoring and verification arrangement agreed between the Agency and the DPRK and foreseen in the Initial Actions agreed at the Six-Party Talks. No verification activities were implemented in the field in 2015, but the Agency continued to monitor the DPRK's nuclear activities by using open source information, including satellite imagery and trade information. Using satellite imagery, the Agency continued to observe signatures during 2015 which were consistent with the operation of the 5 MW(e) reactor at Yongbyon. Renovation or expansion of other buildings was also seen within the Yongbyon site. However, without access to the site, the Agency cannot confirm the operational status of the reactor or the purpose of the other observed activities. The Agency also continued to further consolidate its knowledge of the DPRK's nuclear programme with the objective of maintaining operational readiness to resume safeguards implementation in the DPRK.

The nuclear programme of the DPRK and its ongoing efforts to further develop its nuclear capabilities remain a matter of serious concern. The DPRK's operation of the 5 MW(e) reactor, the ongoing construction at the Yongbyon site, the extension and use of the building housing the reported enrichment facility, and statements about bolstering

[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.

its nuclear deterrent capability are deeply regrettable. Such actions are clear violations of relevant United Nations Security Council resolutions.

Enhancing Safeguards

Evolving safeguards implementation

During 2015, the Agency implemented State-level safeguards approaches for 54 States[17] under integrated safeguards. Six of these approaches were updated during the year and the Secretariat is currently in the process of updating the remainder. The Secretariat is planning to develop such approaches for other States in the future. As described in several documents submitted to the Board of Governors, in developing and implementing a State-level safeguards approach, consultations are held with the relevant State and/or regional authority, particularly on the implementation of in-field safeguards measures.

A State-level safeguards approach is developed in accordance with a State's safeguards agreement, through the conduct of acquisition or diversion path analysis, identification and prioritization of technical objectives, and the selection of safeguards measures to address them. In those States where State-level safeguards approaches under integrated safeguards are not implemented, the safeguards activities to be performed in the field are based on the Agency's Safeguards Criteria.

In 2015, to continue to ensure consistency and non-discrimination in the implementation of safeguards for States with the same type of safeguards agreements, the Agency continued to improve internal work practices, including the better integration of the results of safeguards activities conducted in the field with those carried out at Headquarters, and introduced advances in the handling of safeguards-relevant information to facilitate evaluation. The Agency also prepared new guidance documentation and improved review mechanisms for safeguards implementation.

Cooperation with State and regional authorities

To assist States in building capacity for implementing their safeguards obligations, the Agency published, in February, *Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure* (IAEA Services Series No. 31), the second of four planned Safeguards Implementation Practices Guides. The Agency conducted seven international, regional and national training courses for personnel responsible for overseeing and implementing the State systems of accounting for and control of nuclear material (SSAC), and participated in several other training activities organized by Member States on a bilateral basis. In total, more than 170 participants from more than 50 countries were trained on safeguards related topics. In 2015, the Agency also provided targeted assistance to facility operators to improve their measurement system performance.

"In total, more than 170 participants from more than 50 countries were trained on safeguards related topics."

Safeguards equipment and tools

Throughout 2015, the Agency ensured that the instrumentation and monitoring equipment vital to effective safeguards implementation around the world continued to function as required. Significant financial and human resources were dedicated to maintaining installed equipment to guarantee its high reliability. During the year, 1106 portable and resident non-destructive assay systems comprising 2237 separate pieces of equipment were prepared and assembled for inspection use. By the end of 2015, a total of 162 unattended monitoring systems were in operation worldwide and the Agency had 863 video surveillance systems

[17] And Taiwan, China.

with 1416 individual cameras operating at 266 facilities in 35 States. In addition, the Agency is responsible for maintaining approximately 210 cameras used jointly with regional/State authorities. By the end of 2015, remote data transmission infrastructure ensured collection of 820 unattended safeguards datastreams from 136 facilities in 24 States. Of these, 255 datastreams were produced by surveillance systems, 109 by unattended monitoring systems and 456 by electronic seals.

The Agency continued with the next generation surveillance system (NGSS) implementation campaign, replacing a large number of outdated surveillance units (DCM-14 based technology). In 2015, 532 old video surveillance cameras were replaced with NGSS technology. This replacement campaign is currently partially funded through a dedicated item in the Agency's Major Capital Investment Fund.

"In 2015, 532 old video surveillance cameras were replaced with NGSS technology."

In 2015, cooperative efforts with Member States, the European Commission and the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) continued for procurement, acceptance testing, installation and maintenance of safeguards equipment designated for joint use and for training of relevant staff.

In 2015, the instrumentation technology foresight activities to identify and evaluate emerging instrumentation technologies that could support Agency safeguards implementation continued. These activities were performed in close cooperation with Member State Support Programmes (MSSPs).

The Agency's Network of Analytical Laboratories (NWAL) consists of the Agency's Safeguards Analytical Laboratories (SAL) and 20 other qualified laboratories in Australia, Brazil, France, Hungary, Japan, the Republic of Korea, the Russian Federation, the United Kingdom, the United States of America and the European Commission. Additional laboratories in the areas of environmental and/or nuclear material sample analysis are in the process of qualification in Argentina, Belgium, Canada, China, the Czech Republic, Germany, Hungary, the Netherlands and the United States of America. In 2015, the Agency collected 644 nuclear material samples, all of which were analysed by the Agency's Nuclear Material Laboratory. In 2015, the Agency also collected 323 environmental samples. This resulted in the analysis of 787 sub-samples by the NWAL (including at SAL). Proficiency tests and quality procedures were applied to ensure the correctness and accuracy of all results.

Support

Developing the safeguards workforce

In 2015, the Agency continued updating the Introductory Course on Agency Safeguards, with an emphasis on enhancing teaching methods by delivering training in a more interactive manner. During the year, the Agency conducted over 180 safeguards training courses to provide safeguards inspectors and analysts with the necessary technical and behavioural competencies (Fig. 3). Some of these courses were held at nuclear facilities to enhance practical knowledge of collecting and processing safeguards relevant information, in the field and at Headquarters, in a consistent and integrated manner. New training courses were also developed in 2015, for example, on conducting acquisition path analysis and on developing State-level safeguards approaches. The Agency continued to engage with MSSPs in the development of tools for training and in the conduct of courses at nuclear facilities.

Standing Advisory Group on Safeguards Implementation

The Standing Advisory Group on Safeguards Implementation (SAGSI) held two series of meetings in 2015, at which, inter alia, it considered: internal guidance related to implementation of safeguards at the State level; the MOSAIC project for modernizing

FIG. 3. Agency inspectors use non-destructive assay devices to verify spent fuel assemblies during a training exercise at Dukovany nuclear power plant in the Czech Republic in June.

safeguards information technology infrastructure; and enhancement of performance management.

Significant Safeguards Projects

Enhancing Capabilities of the Safeguards Analytical Services (ECAS)

All remaining transition activities needed to move into the new Nuclear Material Laboratory (NML) were finished during 2015. Additional training and administrative space in the NML office was constructed and the planned security upgrades to the main gate facility, the access road and the site perimeter were completed. Procurement, receipt and installation of remaining equipment for the chemical and instrumentation laboratories was completed during the first two quarters. Active testing in the new facility was completed during the period from May to November, and provisional operation commenced in December, following approval by the Agency's internal regulator and acknowledgement by the Austrian Government. With the completion of the ECAS project in December, the Agency is able to conduct safeguards sample analysis in safe, secure and modern facilities for decades to come.

Information technology: MOSAIC

The Agency's safeguards information technology modernization needs are being addressed through the Modernization of Safeguards Information Technology (MOSAIC) project. In 2015, the Agency completed the first phase of the MOSAIC project by transferring data from the mainframe computer to a new platform, re-engineering the associated software applications and decommissioning the mainframe computer. The new safeguards IT working environment provides the Agency with improved information security, enhanced applications and quicker access to data. During the year, the Agency continued to focus on aligning IT tools with safeguards implementation processes, enhancing existing tools and applications, and further strengthening information security.

Preparing for the Future

Research and development are essential to meeting the safeguards needs of the future. During 2015, the Agency continued implementing the *Department of Safeguards Long-Term Research and Development Plan, 2012–2023* with the assistance of Member State Support Programmes. To address near-term development objectives and to support the implementation of its verification activities, the Agency continued to rely on Member State Support Programmes in implementing its *Development and Implementation Support Programme for Nuclear Verification 2014–2015*. At the end of 2015, 20 States[18] and the European Commission had formal support programmes with the Agency.

[18] 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.

Technical Cooperation

Management of Technical Cooperation for Development

Objective

To enhance the relevance, socioeconomic impact and efficiency of the technical cooperation programme by planning and implementing a need based and responsive technical cooperation programme and by enhancing the technical capacities of Member States in the peaceful application of nuclear technologies.

The Technical Cooperation Programme

The Agency's technical cooperation programme continued to build capacities in Member States to support the peaceful application of nuclear technology, helping to address development priorities in health and nutrition, food and agriculture, water and the environment, industrial applications, and nuclear knowledge development and management. It also helped Member States to identify and meet future energy needs, and to improve nuclear safety and security worldwide, including by providing legislative assistance. Through its technical cooperation programme, the Agency aims to achieve tangible socioeconomic impact by contributing directly in a cost effective manner to the achievement of the major sustainable development priorities of each country, including relevant nationally identified targets under the Sustainable Development Goals (SDGs).

Country Programme Frameworks and Revised Supplementary Agreements

The Country Programme Framework (CPF) serves as one of the main reference documents and the main planning tool for the development of the national technical cooperation programmes for Member States receiving technical cooperation assistance. In 2015, CPFs were signed by 15 Member States — Azerbaijan, Bosnia and Herzegovina, Colombia, Czech Republic, Egypt, Fiji, Georgia, Indonesia, Marshall Islands, Mongolia, Palau, Papua New Guinea, Sudan, Tunisia and Viet Nam.

The Agency continued in 2015 to further strengthen the analytical content of the CPF, with a focus on assisting Member State authorities in identifying relevant national and international partners for their CPF and their projects, and in linking technical cooperation assistance to national sustainable development priorities. This approach supports more effective resource mobilization and longer term partnerships, and a move from small scale, short duration national projects to larger scope programmes that offer greater opportunities for social and economic benefits and longer term national development impact.

Revised Supplementary Agreements Concerning the Provision of Technical Assistance by the IAEA (RSAs) govern the provision of technical assistance by the Agency. Fiji's RSA entered into force in 2015.

Managing the Agency's Technical Cooperation Programme

"Member State priorities in 2015 ... were safety, health and nutrition, and food and agriculture"

Member State priorities in 2015, as reflected in programme disbursements, were safety, health and nutrition, and food and agriculture (Fig. 1), with some variations in emphasis across regions. By the end of the year, 807 projects were active. During the course of the year, 261 projects were closed, of which three were cancelled in consultation with the relevant Member States, and an additional 278 projects were in the process of being closed. Eight Programme Reserve projects were implemented, in Burkina Faso, Côte d'Ivoire, Ghana, Myanmar, Nepal, Niger, Nigeria and the Philippines.

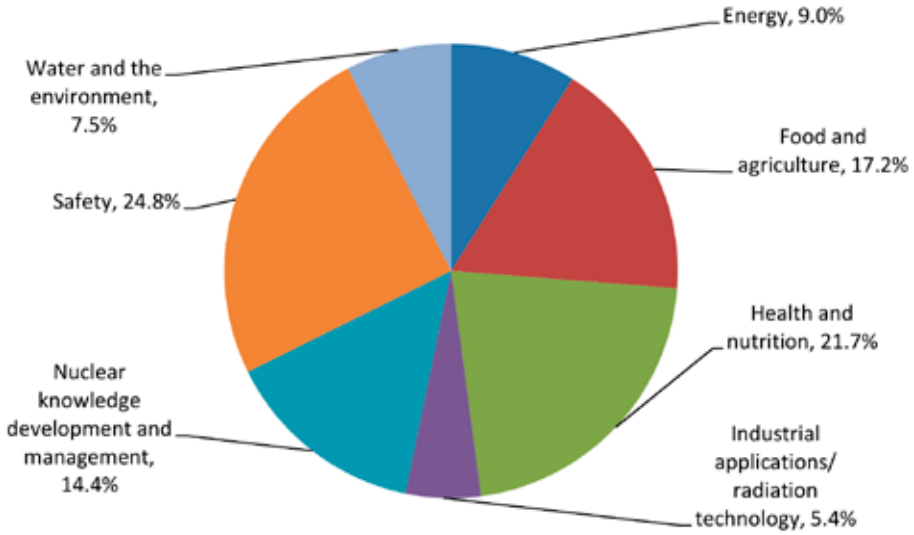

FIG. 1. Actuals by technical field for 2015. (Percentages may not add up to 100% owing to rounding.)

Financial Highlights

Payments against the 2015 Technical Cooperation Fund (TCF) totalled €65.5 million (not including National Participation Costs and assessed programme cost arrears), against the target of €69.8 million, with the rate of attainment on payments as at 31 December 2015 standing at 93.8% (Fig. 2). The use of these resources resulted in a TCF implementation rate of 84.8%. Total payments received in 2015 include €2.4 million either of deferred or of additional payments by 16 Member States. Excluding these payments, the 2015 rate of attainment on payments would have been lower by 3.4%.

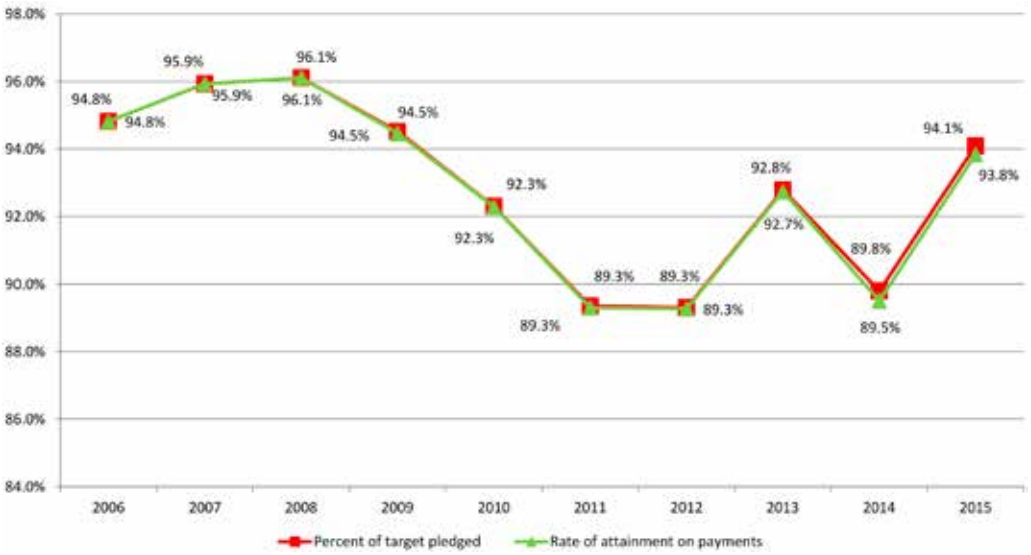

FIG. 2. Trends in the rate of attainment, 2006–2015.

Improving the Quality of the Technical Cooperation Programme

In line with continuing efforts to enhance the quality of the technical cooperation programme, in 2015 the Agency supported Member States as they developed their projects for the 2016–2017 technical cooperation cycle. The goal was to ensure that the projects would be of high quality, with measurable, attainable and timely objectives. Country visits, project design meetings, workshops, training events and programme briefings were conducted for a range of technical cooperation stakeholders, including project counterparts and National Liaison Officers (NLOs). These provided support in the efficient and effective use of the logical framework approach for the design of new projects and of monitoring and evaluation tools for ongoing projects.

For example, NLOs from the Africa region attended an induction workshop in April 2015, which aimed at enhancing common understanding of the Agency's technical cooperation programme. Participants discussed challenges in delivering the programme and received an update on the programme review and assessment process. At a second event, NLOs learned about best practices and experiences resulting from the design and formulation of the 2016–2017 technical cooperation cycle. Discussions were held on the alignment of CPFs with the Common African Position on the Post-2015 Development Agenda and on the SDGs.

In the Asia and the Pacific region, the Agency held an induction workshop for new NLOs and National Liaison Assistants at Agency Headquarters in June, providing a grounding in what the technical cooperation programme can provide to Member States. The Agency carried out intensive upstream work throughout the year in preparation for the 2016–2017 technical cooperation programme, which resulted in the development of 174 national and 33 regional technical cooperation projects. It provided extensive support to new Member States in the region, including a subregional training course for small island developing States and Brunei Darussalam to provide training in establishing a regulatory entity and in preparing a quality national technical cooperation programme.

Finally, the Agency conducted two quality reviews of project designs for the 2016–2017 technical cooperation cycle to provide sound and constructive feedback to the project teams on improving the quality of their projects, to obtain an overall assessment of the quality of the 2016–2017 technical cooperation programme, and to identify lessons learned and areas for improvement in future technical cooperation cycles.

Monitoring and Evaluating Technical Cooperation Projects

Member States and potential donors are increasingly interested in seeing how the technical cooperation programme contributes to promoting and improving the scientific, technological, research and regulatory capabilities of Member States through the development of effective programmes with well defined outcomes. In preparation for the 2016–2017 technical cooperation cycle, the Agency developed specific monitoring and evaluation plans covering the entire project life cycle for selected technical cooperation projects. The experience gained and lessons learned during the development process are expected to provide a basis for expanded outcome monitoring in future technical cooperation cycles.

Also during the year, the Agency continued to review complementary monitoring instruments such as Project Progress Assessment Reports (PPARs), field monitoring missions (Fig. 3) and self-evaluations. These instruments provide a mechanism to identify and communicate lessons learned, and give a valuable snapshot of the status of completion of project outputs.

FIG. 3. Participants in a field monitoring mission to Beirut, Lebanon.

Partnerships with the United Nations System and Other International Organizations

In 2015, the Agency continued its engagement with the United Nations system, other international organizations, research organizations and non-governmental organizations. The Agency will place increased emphasis on partnerships for improving the socioeconomic impact of its projects, and for contributing to, inter alia, Sustainable Development Goal 17 (Strengthen the means of implementation and revitalize the global partnership for sustainable development) and its targets.

United Nations Development Assistance Frameworks

During the year, the Agency continued to contribute to the development and implementation of United Nations Development Assistance Frameworks (UNDAFs) in relevant countries. UNDAFs offer a useful framework for identifying potential areas of collaboration between the Agency and other United Nations entities, and help to ensure minimal overlap between the actions of different agencies. By identifying linkages between the goals and objectives of the CPF and those of the UNDAF, joint work to address national priorities in sustainable development can be facilitated. In 2015, the Agency participated in the preparation process and co-signed the UNDAF for Algeria, which covers the period 2016–2020. It was also involved in finalization of the ZUNDAF for Zimbabwe, which covers the period 2016–2020. This was signed by the United Nations Resident Coordinator on the behalf of the Agency in May. The United Nations Partnership Agreement Framework for Indonesia was renewed in 2015, incorporating Indonesia's planned national technical cooperation programme into the new United Nations comprehensive framework. In Europe, the Agency signed the UNDAF for Belarus in October. This document also describes the progress made in preparations for the introduction of nuclear power into the country's energy mix. In November, the Agency signed the UNDAF for Georgia, covering the period 2016–2020. The Agency will contribute through its technical cooperation national projects to the country's development in three of the eight outcomes contained in the document, covering livelihood and social protection, health, and human security and resilience. To date, the Agency has signed 42 UNDAFs in total.

"To date, the Agency has signed 42 [United Nations Development Assistance Frameworks] in total."

Cooperation with the United Nations and Other International Organizations

During the year, the Agency strengthened its cooperation with national focal points of the United Nations Convention to Combat Desertification (UNCCD) in support of sustainable land management in the Africa and the Asia and the Pacific regions. The Agency organized a side event at the twelfth session of the Conference of the Parties to the UNCCD (COP12) in Turkey, in collaboration with UNCCD national focal points in the environment ministries of Morocco and Madagascar. The environmental officials stressed the importance of embedding soil science (including soil erosion measurements using isotopes) not only in the national research agenda, but also in the national environmental decision making agenda.

The Agency continued its efforts to strengthen the relevance of its nutrition projects by linking them with national nutrition priorities in Member States as part of the Scaling Up Nutrition (SUN) movement. It reached out to the African Union led African Task Force on Food and Nutrition Development in South Africa in March, presenting planned nutrition interventions to better align them with national health priorities. To this end, a new interregional project on reducing stunting among children under five years of age has been developed jointly with Ministry of Health officials in participating countries. The first coordination meeting for this project took place in Vienna in August, with the participation of stunting-affected Member States, the World Bank, the SUN movement and other stakeholders.

To enhance the support given to countries affected by the Ebola virus disease and to better coordinate international efforts, the Agency participated in and organized meetings with the World Health Organization (WHO), the United States Centers for Disease Control and Prevention, South Africa's National Institute for Communicable Diseases and other international partners. It also launched an extrabudgetary and off cycle cooperation programme to enhance regional capabilities to detect emerging zoonotic diseases, including Ebola virus disease and avian flu.

Under a technical cooperation project entitled 'Supporting a Feasibility Study on the Suitability of the Sterile Insect Technique as a Strategy for the Integrated Control of Anopheles Arabiensis', the Agency organized a meeting with the Islamic Development Bank, the Tropical Medicine Research Institute, the Permanent Mission of the Republic of the Sudan, and the Sudan Atomic Energy Commission. The meeting resulted in an agreement by the Islamic Development Bank to fund a gamma irradiator for applying the sterile insect technique to mosquitoes and the planning of an extensive recruitment programme; it also included an update on the construction of the mass rearing facility.

In the Asia and the Pacific region, five Practical Arrangements were concluded. These were with the International Center for Biosaline Agriculture, United Arab Emirates, to promote cooperation in the area of soil, water, crop and nutrient management; the Kuwait Institute for Scientific Research, for cooperation on marine environmental monitoring and protection; the King Hussein Cancer Center, Jordan, and the Chonnam National University, Republic of Korea, to establish the framework for cooperation in the area of capacity building for IAEA Curricula for Nuclear Medicine Professionals; and the National Oceanic and Atmospheric Administration, United States of America, for cooperation related to harmful algal blooms. These Practical Arrangements establish opportunities for joint programming and complementarities with a number of Member States, as well as the possibility of taking advantage of the expertise of specialized entities. An Agreement was also signed with the International Rice Research Institute in the Philippines, for cooperation in the field of enhanced rice productivity.

The Agency also played a role in the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) Forum in July, which established regional mechanisms for monitoring and accountability in transitioning from the Millennium Development Goals to the post-2015 development agenda (the SDGs).

In Latin America and the Caribbean, the Agency continued to expand its cooperation with traditional United Nations and non–United Nations partners, and to explore opportunities for cooperation in support of sustainable development with new partners in the region. In the field of human health, the Agency signed a Practical Arrangement with the Spanish Medical Colleges Organization (OMC) to work together to improve radiation medicine in countries in Latin America and the Caribbean. In addition, in conjunction with the Pan American Health Organization, the Agency organized several joint missions to support the health regulatory authorities of Member States.

The European Commission funded the First School of Emergency Management in Latin America and the Caribbean, implemented under a regional project entitled 'Strengthening of National Capabilities for Response to Radiation Emergencies' and held in Brazil at the end of 2015. In collaboration with the Food and Agriculture Organization of the United Nations (FAO) and UNCCD, and on the occasion of the 2015 International Year of Soils, the Agency improved regional capacities to measure soil water content, identify soil erosion patterns and soil degradation hot spots, and trace nitrogen fertilizer movement to optimize nitrogen use efficiency through a regional project entitled 'Strengthening Soil and Water Conservation Strategies at the Landscape Level by Using Innovative Radio and Stable Isotope and Related Techniques'. The Agency strengthened its cooperation with the National Center for Electron Beam Research of Texas A&M University, and the Animal and Plant Health Inspection Service and the Agricultural Research Service of the United States Department of Agriculture, within the framework of a project entitled 'Increasing the Commercial Application of Electron Beam and X Ray Irradiation Processing of Food', to enhance phytosanitary control of fresh fruit and vegetables.

Finally, the Agency provided technical assistance to support national efforts to contain the outbreak of Mediterranean fruit fly detected in the Dominican Republic. An action plan was implemented in collaboration with FAO, the Inter-American Institute for Cooperation on Agriculture of the Organization of American States, the International Regional

Organization for Plant and Animal Health (OIRSA) and the United States Department of Agriculture.

Regional Agreements and Programming

Regional agreements and other Member State groups promote horizontal cooperation, self-reliance and sustainability. Agency collaboration with these groups has led to stronger regional technical cooperation programmes that are focused on priorities identified at the regional level.

The African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) continues to be the principal framework for promoting technical cooperation among developing countries in Africa and for enhancing regional cooperation among its 39 State Parties.

During the 59th regular session of the Agency's General Conference, AFRA organized an exhibition to highlight the unique contribution of its 28 regional designated centres in different fields, including human health, food and agriculture, industry, safety, energy and isotope hydrology. The 26th Meeting of AFRA Representatives also took place during the 59th General Conference. Participants adopted the *AFRA Annual Report 2014* and the *AFRA Mid-Term Strategy 2016–2018*, which is aligned with the SDGs and the Common African Position on the post-2015 Development Agenda endorsed by the Heads of State and Government of the African Union.

In July 2015, Morocco hosted the 26th AFRA Technical Working Group Meeting in Marrakech. The meeting participants reviewed and adopted concrete measures and actions to further enhance the implementation of AFRA regional projects and the management of its cooperative activities.

AFRA continued to implement its partnership building and resource mobilization strategy through a series of meetings in December between the AFRA Chair and the Vienna-based African Group and Resident Representatives of donor and potential partner countries in Vienna, sharing information on AFRA's policy and programme related matters. In 2015, the total contribution of AFRA State Parties to the AFRA Fund was €298 211, demonstrating the Parties' continued commitment.

With regard to the 2016–2017 technical cooperation cycle, AFRA prepared six project designs in human health, food safety, radiation safety, technical cooperation among developing countries and triangular cooperation, and AFRA management. The new programme places high priority on enhancing human resource development and strengthening existing infrastructure in the region.

In the Asia and the Pacific region, the Board of Representatives of the Co-operative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA) adopted the strategic document *ARASIA Strategy and Cooperative Thrusts (2018–2027)* in September as strategic guidance on the overall upstream planning of ARASIA activities for 2018–2027. The document serves as a frame of reference for the preparation of specific programmes. By leveraging existing regional collaboration, the ARASIA agreement can further accelerate the process of development, and enable a process of knowledge transfer and sharing of capabilities.

Also in the Asia and the Pacific region, the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA) adopted its new medium term strategy for the period 2018–2023, identifying common strategic priorities to be addressed through the technical cooperation programme. The new strategy therefore provides an opportunity to address common regional challenges through enhanced south–south cooperation and provides direction for the development of future programme cycles.

Upstream work on the preparation of the Regional Programme Framework (RPF) for Asia and the Pacific (2018–2028) started in December with discussions on the mechanisms, the outline and the timeline for the document. The RPF will set priorities for the development of regional programming over the next ten years, complementing other related strategic documents and correlating priorities with the SDGs.

In the Europe region, two agreements to facilitate the implementation of regional projects in the human health sector were signed with the European Association of Nuclear Medicine and the European Society for Radiotherapy and Oncology, for the joint management of training courses in radiotherapy and nuclear medicine.

The Agency carried out a thorough assessment of the new technical cooperation regional programme for Europe, based on the priorities established in the Regional Profile for Europe. As in previous years, the main regional activities were within four priority thematic areas: human health, radioactive waste management and environment restoration, nuclear power, and nuclear and radiation safety.

The Regional Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL), which promotes and coordinates activities for training, development and applications of nuclear science and technology, was extended for the first time for an additional period of five years, effective as of 5 September 2015. With Agency support, the Guidelines and Operating Rules for the ARCAL Agreement were revised and updated. This will contribute to strengthening implementation of the Agreement and will ensure high quality in the development and delivery of the ARCAL programme.

The regional projects submitted by ARCAL for the 2016–2017 technical cooperation cycle address the needs and priorities identified in *ARCAL Regional Strategic Profile for Latin America and the Caribbean (RSP) 2016–2021* (IAEA-TECDOC-1763). The RSP served as a key programmatic tool for the development of the new proposals and is expected to help foster regional cooperation and promote cooperation between countries.

Programme of Action for Cancer Therapy (PACT)

The Agency continued to support low and middle income countries in strengthening national cancer control capacities throughout 2015, while advocating for the sustainable integration of radiation medicine in comprehensive national cancer control strategies.

"Through PACT, the Agency conducted eight imPACT review missions ... and identified opportunities to strengthen healthcare relevant radiation safety infrastructure and improve the management of radioactive sources."

In 2015, recognition of PACT's role as a key player in cancer control increased through the strengthening of ties with strategic partners and the organization of discussions at important cancer related events such as the Stop Cervical, Breast and Prostate Cancer in Africa Conference, held in Kenya, and the Islamic Conference of Health Ministers and the World Cancer Leaders' Summit, held in Turkey. The Agency also conducted a number of training and capacity building workshops during the year, including a workshop on resource mobilization for cancer control for ten Francophone countries held in November at the International Cancer Conference of the African Organisation for Research and Training in Cancer (AORTIC) in Morocco.

Integrated missions of PACT (imPACT) reviews, related expert missions and capacity building measures continued to provide Member States with a broad platform for country wide comprehensive cancer control planning and implementation. Through PACT, the Agency conducted eight imPACT review missions, to Algeria, Bosnia and Herzegovina, Dominica, El Salvador, Kyrgyzstan, Madagascar, Mauritania and Myanmar, and identified opportunities to strengthen healthcare relevant radiation safety infrastructure and improve the management of radioactive sources.

The Agency continued to support PACT Model Demonstration Sites in Ghana, Mongolia, Nicaragua, Sri Lanka, the United Republic of Tanzania and Viet Nam through expert advice, capacity building and the provision of training and equipment. For example, Mongolia upgraded the radiotherapy treatment planning system at the National Cancer

Centre, with funding from Japan and the Principality of Monaco; Nicaragua continued to implement a project seeking to strengthen diagnosis of cervical and breast cancer at Bertha Calderón Hospital in Managua, with funding from Spain; Viet Nam initiated a cervical cancer screening campaign in the Hanoi and Can Tho regions, with funding from the OPEC Fund for International Development (OFID); and the United Republic of Tanzania continued to enhance palliative care services, also funded through OFID.

Following the completion in 2014 of the first five year cycle of the Advisory Group on Increasing Access to Radiotherapy Technology in Low and Middle Income Countries (AGaRT), the Agency facilitated a consultation process to plan for the group's next phase (2015–2020). AGaRT's objective is to provide advice to Member States on access to affordable, sustainable, quality radiotherapy solutions through maximizing opportunities offered by existing global initiatives and partnerships in cancer control programming.

Within the framework of the United Nations Interagency Task Force on the Prevention and Control of Non-Communicable Diseases, preparatory work continued on the joint project on cancer control being undertaken by the Agency, the International Agency for Research on Cancer (IARC) and WHO, which aims to support the planning and implementation of comprehensive cancer control programmes in a selected group of Member States.

Following the conclusion of the pilot phase of the Virtual University for Cancer Control and Regional Training Network (VUCCnet) in December 2014, the programme underwent a full review in 2015. The results confirmed VUCCnet's ability to substantially contribute to improving human capacity development and training in low and middle income countries. As requested by Member States, plans are being developed to scale up the project across sub-Saharan Africa.

Donors remained unwavering in their commitment to PACT's efforts to strengthen national cancer control capacities. In 2015, PACT received €719 765 in extrabudgetary contributions from Agency Member States and partners for cancer control activities.

Through PACT, the Agency provided input from a comprehensive cancer control perspective to the preparation of technical cooperation projects for the 2016–2017 technical cooperation programme cycle. This informed many components, including national cancer control infrastructure and capacity, the involvement of relevant stakeholders and partners, and the development of resource mobilization strategies and targeted opportunities.

Outreach and Communication

Agency outreach to Member States, current and potential partners, donors and the international development community was undertaken through a range of different communication channels in 2015. These included attendance at relevant meetings, participation in exhibitions, and presentations on the technical cooperation programme at various outreach and training events. The Agency used these opportunities to showcase its work in specific topic areas and to raise awareness of its technical cooperation programme among potential partners.

Exhibitions focusing on technical cooperation activities were organized at the International Conference on Global Emergency Preparedness and Response, the Asia-Pacific Forum on Sustainable Development 2015, and the Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure, among others. At the 59th regular session of the Agency's General Conference, the Agency hosted a number of side events related to technical cooperation. These included a session to explore the Agency's role in the post-2015 development agenda and its potential contribution to the achievement of the SDGs; the introduction of a cancer staging smartphone application for medical professionals, developed through a project entitled 'Improving Cancer Management Through Strengthening the Computed Tomography Cancer Staging Process'; and the presentation of Member State experience and successes in soil management, highlighted at a side event entitled 'Managing

Soils for Climate Smart Agriculture'. The Programme of Action for Cancer Therapy also held a side event on addressing cancer, entitled 'The Future We Want'.

In October, the Agency held the Annual Seminar on Technical Cooperation for Diplomats at its Headquarters in Vienna. Designed to provide Permanent Missions with a comprehensive overview of the technical cooperation programme, the seminar was attended by 55 participants.

The Agency also posted targeted outreach material of relevance to specific 'United Nations Days', including World Cancer Day, World Water Day, World Environment Day and International Women's Day, using social media and the web to promote relevant technical cooperation activities.

"In 2015, the [technical cooperation web] site received over 113 000 visits."

The technical cooperation web site was updated with 94 web articles, 9 photo essays and 10 videos during 2015, and now has some 9476 visitors a month. In 2015, the site received over 113 000 visits. More than 900 tweets were sent out from the @IAEATC Twitter account. As of December 2015, the account had over 2500 followers, and the IAEA TC Fellows Alumni Group on LinkedIn now has over 1400 members. The Agency issued a number of new outreach products, including new technical cooperation project success stories and fact sheets on emergency preparedness and response, and soil conservation.

Legislative Assistance

In 2015, the Agency continued to provide legislative assistance to its Member States through the technical cooperation programme. Country specific bilateral legislative assistance was provided to 18 Member States through written comments and advice on drafting national nuclear legislation. The Agency also reviewed the legislative framework of newcomer countries as part of Integrated Nuclear Infrastructure Review missions. Short term scientific visits to Agency Headquarters were organized for a number of individuals, allowing fellows to gain further practical experience in nuclear law.

The Agency organized the fifth session of the Nuclear Law Institute, held in Baden, Austria, from 28 September to 9 October 2015. The comprehensive two week course, which uses teaching methods based on interaction and practice, is designed to meet the increasing demand by Member States for legislative assistance and to enable participants to acquire a solid understanding of all aspects of nuclear law, as well as to draft, amend or review their national nuclear legislation. Sixty-three representatives from Member States participated. The Agency also continued to contribute to the activities organized at the World Nuclear University and the International School of Nuclear Law by providing lectures and sponsoring participants through appropriate technical cooperation projects.

Training courses and workshops on nuclear law were organized in Costa Rica, Guatemala, Malaysia and South Africa, drawing 60 participants from these countries. The workshops addressed all aspects of nuclear law and created a forum for the exchange of views on topics relating to the international legal instruments.

Treaty Event

The Agency's fifth Treaty Event took place during the 59th regular session of the General Conference, providing Member States with a further opportunity to deposit their instruments of ratification, acceptance or approval of, or accession to, the treaties deposited with the Director General, notably those related to nuclear safety, security and civil liability for nuclear damage. The special focus of this year's Treaty Event was again the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM). Representatives from several Member States were also briefed on the conventions adopted under Agency auspices.

Annex

Table A1.	Regular Budget allocation and utilization of resources in 2015 by Programme and Major Programme (in euros)
Table A2.	Extrabudgetary regular programme fund resource utilization in 2015 by Programme and Major Programme (in euros)
Table A3(a).	Disbursements (actuals) by technical field and region in 2015
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Note: Tables A25–A30 are available on the attached CD-ROM.

Table A1. Regular Budget allocation and utilization of resources in 2015 by Programme and Major Programme (in euros)

Major Programme (MP)/Programme	Original budget US $1/€1	Adjusted budget US $1/€0.9016	Expenditure	Resource utilization	Unobligated balances
	a	b	c	d = c/b	e = b - c
MP1 — Nuclear Power, Fuel Cycle and Nuclear Science					
Overall management, coordination and common activities [a]	2 663 938	2 628 192	2 646 951	100.7%	(18 759)
Nuclear Power	8 024 737	7 901 795	7 915 475	100.2%	(13 680)
Nuclear Fuel Cycle and Materials Technologies	3 533 982	3 490 976	3 725 015	106.7%	(234 039)
Capacity Building and Nuclear Knowledge Maintenance for Sustainable Energy Development	10 436 076	10 301 565	9 933 299	96.4%	368 266
Nuclear Science	10 203 238	10 100 513	10 176 345	100.8%	(75 832)
Total Major Programme 1	**34 861 971**	**34 423 041**	**34 397 085**	**99.9%**	**25 956**
MP2 — Nuclear Techniques for Development and Environmental Protection					
Overall management, coordination and common activities [a]	7 217 681	7 162 622	7 038 568	98.3%	124 054
Food and Agriculture	11 417 394	11 294 884	11 425 067	101.2%	(130 183)
Human Health (excluding PACT in 2014–2015)	8 270 472	8 174 222	8 239 654	100.8%	(65 432)
Water Resources	3 471 543	3 432 898	3 449 310	100.5%	(16 412)
Environment	6 262 348	6 185 091	6 161 395	99.6%	23 696
Radioisotope Production and Radiation Technology	2 249 194	2 225 545	2 157 373	96.9%	68 172
Total Major Programme 2	**38 888 632**	**38 475 262**	**38 471 367**	**100.0%**	**3 895**
MP3 — Nuclear Safety and Security					
Overall management, coordination and common activities [a]	4 417 163	4 356 009	4 077 779	93.6%	278 230
Incident and Emergency Preparedness and Response	3 817 461	3 767 140	3 815 836	101.3%	(48 696)
Safety of Nuclear Installations	10 040 192	9 868 348	9 822 821	99.5%	45 527
Radiation and Transport Safety (including Radiation Protection Services in 2014–2015)	7 075 966	6 965 499	6 939 011	99.6%	26 488
Management of Radioactive Waste	7 054 576	6 946 699	7 211 011	103.8%	(264 312)
Nuclear Security	5 150 343	5 058 498	5 081 753	100.5%	(23 255)
Total Major Programme 3	**37 555 701**	**36 962 193**	**36 948 211**	**100.0%**	**13 982**
MP4 — Nuclear Verification					
Overall management, coordination and common activities [a]	12 962 211	12 810 460	13 534 906	105.7%	(724 446)
Safeguards Implementation	113 520 441	111 907 851	106 410 873	95.1%	5 496 978
Other Verification Activities	537 002	525 993	572 046	108.8%	(46 053)
Development	5 520 438	5 428 340	10 143 423	186.9%	(4 715 083)
Total Major Programme 4	**132 540 092**	**130 672 644**	**130 661 248**	**100.0%**	**11 396**
MP5 — Policy, Management and Administration Services					
Policy, Management and Administration Services [a]	77 687 366	76 980 622	76 660 553	99.6%	320 069
Total Major Programme 5	**77 687 366**	**76 980 622**	**76 660 553**	**99.6%**	**320 069**
MP6 — Management of Technical Cooperation for Development					
Management of Technical Cooperation for Development [a]	23 797 704	23 445 973	23 311 006	99.4%	134 967
Total Major Programme 6	**23 797 704**	**23 445 973**	**23 311 006**	**99.4%**	**134 967**
Total Operational Regular Budget	**345 331 466**	**340 959 735**	**340 449 470**	**99.9%**	**510 265**
Major Capital Investment Funding Requirements					
MP1 — Nuclear Power, Fuel Cycle and Nuclear Science	–	–	–	–	–
MP2 — Nuclear Techniques for Development and Environmental Protection	2 699 528	2 699 528	–	0.0%	2 699 528
MP3 — Nuclear Safety and Security	–	–	–	–	–
MP4 — Nuclear Verification	2 284 216	2 284 216	5 336	0.2%	2 278 880
MP5 — Policy, Management and Administration Services	3 322 496	3 322 496	971 081	29.2%	2 351 415
MP6 — Management of Technical Cooperation for Development	–	–	–	–	–
Total Capital Regular Budget	**8 306 240**	**8 306 240**	**976 417**	**11.8%**	**7 329 823**
Total Agency Programmes	**353 637 706**	**349 265 975**	**341 425 887**	**97.8%**	**7 840 088**
Reimbursable work for others	2 845 593	2 845 593	2 930 617	103.0%	(85 024)
Total Regular Budget	**356 483 299**	**352 111 568**	**344 356 504**	**97.8%**	**7 755 064**

Column a: General Conference resolution GC(58)/RES/6 of September 2014 original budget at US $1/€1.

Column b: Original budget revalued at the United Nations operational average rate of exchange of €0.9016 to US $1 in 2015.

[a] Includes the Corporate Shared Services presented as a separate programme in Table A1 of *IAEA Annual Report 2014* (GC(59)/7).

Table A2. Extrabudgetary regular programme fund resource utilization in 2015 by Programme and Major Programme (in euros)

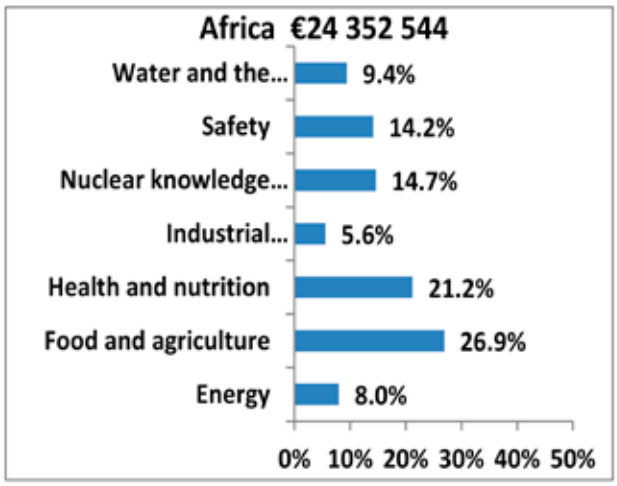
Major Programme (MP)/Programme	2015 expenditure
MP1 — Nuclear Power, Fuel Cycle and Nuclear Science	
Overall management, coordination and common activities	55 359
Nuclear Power	3 139 636
Nuclear Fuel Cycle and Materials Technologies	3 191 392
Capacity Building and Nuclear Knowledge Maintenance for Sustainable Energy Development	587 977
Nuclear Science	4 150 027
Total Major Programme 1	**11 124 391**
MP2 — Nuclear Techniques for Development and Environmental Protection	
Overall management, coordination and common activities	2 759 943
Food and Agriculture	3 050 847
Human Health	321 963
Water Resources	17 473
Environment	1 299 432
Radioisotope Production and Radiation Technology	40 702
Total Major Programme 2	**7 490 360**
MP3 — Nuclear Safety and Security	
Overall management, coordination and common activities	5 618 131
Incident and Emergency Preparedness and Response	442 320
Safety of Nuclear Installations	6 060 223
Radiation and Transport Safety (including Radiation Protection Services in 2014–2015)	2 411 498
Management of Radioactive Waste	2 000 390
Nuclear Security	22 125 336
Total Major Programme 3	**38 657 898**
MP 4 — Nuclear Verification	
Overall management, coordination and common activities	1 646 534
Safeguards Implementation	14 136 584
Other Verification Activities	4 185
Development	11 240 666
Total Major Programme 4	**27 027 969**
MP 5 — Policy, Management and Administration Services	
Policy, Management and Administration Services	1 482 738
Total Major Programme 5	**1 482 738**
MP 6 — Management of Technical Cooperation for Development	
Management of Technical Cooperation for Development	56 456
Total Major Programme 6	**56 456**
Total extrabudgetary programme funds	**85 839 812**

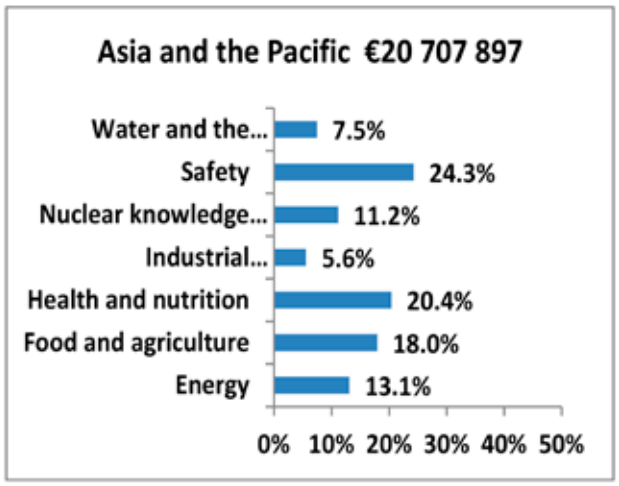
Table A3(a). Disbursements (actuals) by technical field and region in 2015

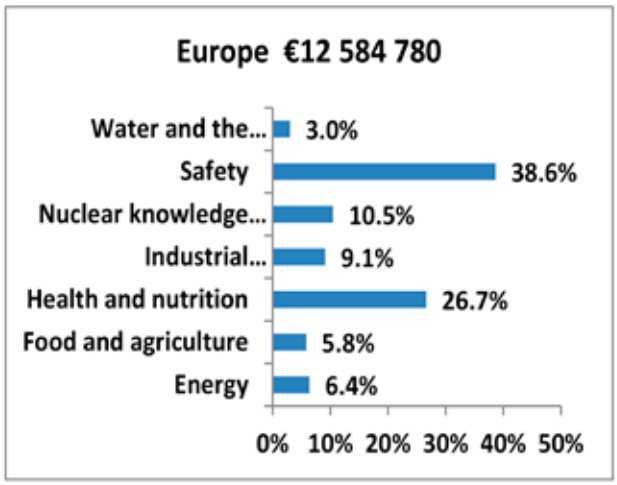
Summary of all regions (in euros)							
Technical field	**Africa**	**Asia and the Pacific**	**Europe**	**Latin America**	**Global/ interregional**	**PACT [a]**	**Total**
Energy	1 946 413	2 715 032	801 641	574 921	910 599		**6 948 606**
Food and Agriculture	6 557 027	3 722 483	729 270	1 887 239	401 163		**13 297 181**
Health and Nutrition	5 166 563	4 225 201	3 354 500	2 790 965	393 828	781 122	**16 712 179**
Industrial Applications/ Radiation Technology	1 362 370	1 156 541	1 146 371	433 491	35 365		**4 134 138**
Nuclear Knowledge Development and Management	3 571 673	2 311 951	1 317 147	1 810 638	2 138 287		**11 149 695**
Safety	3 447 452	5 028 049	4 863 583	3 764 471	2 041 063		**19 144 619**
Water and the Environment	2 301 047	1 548 639	372 269	1 583 455	80		**5 805 490**
Total	**24 352 544**	**20 707 897**	**12 584 780**	**12 845 179**	**5 920 385**	**781 122**	**77 191 908**

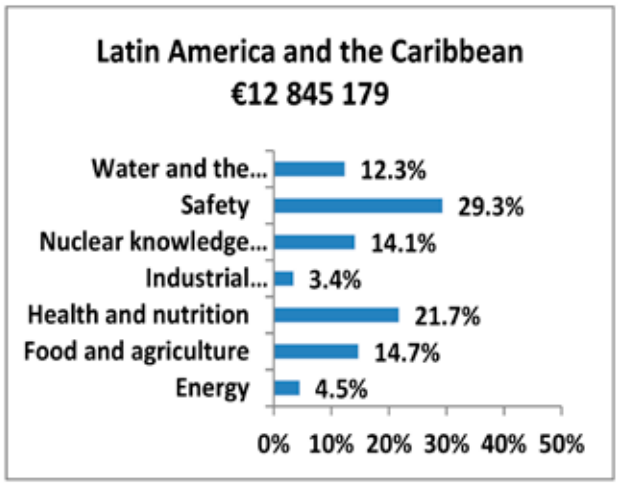
[a] PACT: Programme of Action for Cancer Therapy.

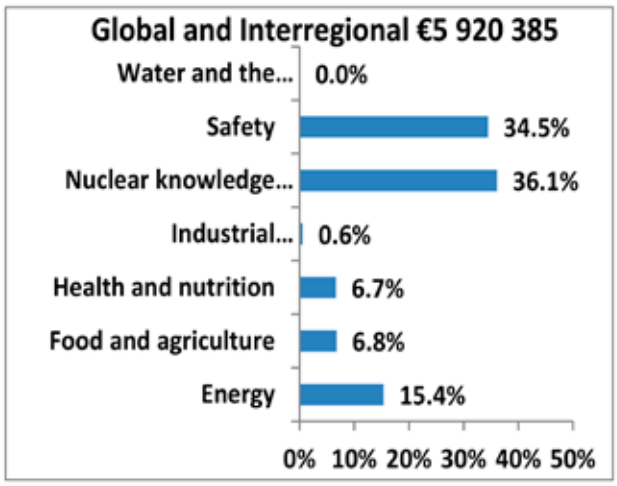
Table A3(b). Graphical representation of the information in Table A3(a)

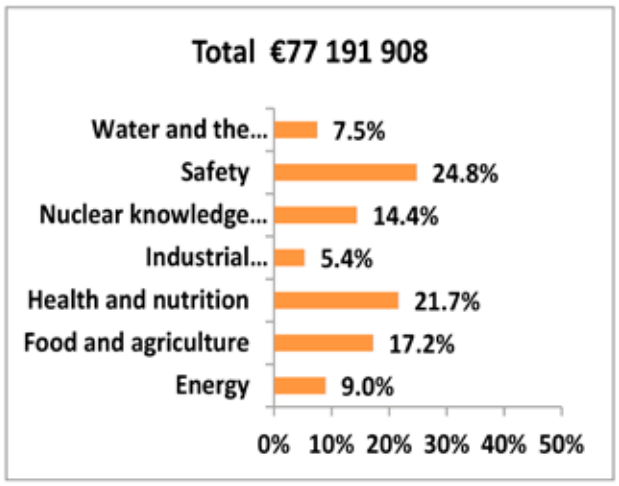












Note: See Table A3(a) for the full titles of the technical field.

Table A4. Amount of nuclear material under Agency safeguards at the end of 2015 by type of agreement

Nuclear material	Comprehensive safeguards agreement[a]	INFCIRC/66-type agreement	Voluntary offer agreement	Quantity in significant quantities (SQs)
Plutonium[b] contained in irradiated fuel and in fuel elements in reactor cores	131 937	2 231	18 924	153 092
Separated plutonium outside reactor cores	1 678	5	10 479	12 162
High enriched uranium (equal to or greater than 20% U-235)	188	1	0	189
Low enriched uranium (less than 20% U-235)	18 750	213	1 463	20 426
Source material[c] (natural and depleted uranium and thorium)	10 249	557	3 417	14 224
U-233	18	0	0	18
Total SQs of nuclear material	**162 820**	**3 007**	**34 283**	**200 110**

Amount of heavy water under Agency safeguards at the end of 2015 by type of agreement				
Non-nuclear material[d]	**Comprehensive safeguards agreement**	**INFCIRC/66-type agreement**	**Voluntary offer agreement**	**Quantity in tonnes**
Heavy water (tonnes)		**430.5**		**431.2[e]**

[a] Includes nuclear material under Agency safeguards in Taiwan, China; excludes nuclear material in the Democratic People's Republic of Korea.

[b] The quantity includes an estimated amount (10 800 SQs) of plutonium in fuel elements loaded into reactor cores and plutonium in other irradiated fuel, which has not yet been reported to the Agency under agreed reporting procedures.

[c] This table does not include material within the terms of subparagraphs 34(a) and 34(b) of INFCIRC/153 (Corrected).

[d] Non-nuclear material subject to Agency safeguards under INFCIRC/66/Rev.2-type agreements.

[e] Includes 0.7 tonnes of heavy water under Agency safeguards in Taiwan, China.

Table A5. Number of facilities and material balance areas outside facilities under Agency safeguards during 2015

Type	Comprehensive safeguards agreement[a]	INFCIRC/66-type agreement	Voluntary offer agreement	Total
Power reactors	241	12	1	254
Research reactors and critical assemblies	150	3	1	154
Conversion plants	18	0	0	18
Fuel fabrication plants	41	2	1	44
Reprocessing plants	9	0	1	10
Enrichment plants	16	0	3	19
Separate storage facilities	125	2	4	131
Other facilities	79	0	0	79
Facility subtotals	679	19	11	709
Material balance areas containing locations outside facilities[b]	576	1	0	577
Total	**1255**	**20**	**11**	**1286**

[a] Includes facilities under Agency safeguards in Taiwan, China; excludes facilities in the Democratic People's Republic of Korea.

[b] Includes 54 material balance areas in States with amended small quantities protocols.

Table A6. Conclusion of safeguards agreements, additional protocols and small quantities protocols (as of 31 December 2015)

State [a]	Small quantities protocols [b]	Safeguards agreements [c]	INFCIRC	Additional protocols
Afghanistan	X	In force: 20 Feb. 1978	257	In force: 19 July 2005
Albania[1]		In force: 25 March 1988	359	In force: 3 Nov. 2010
Algeria		In force: 7 Jan. 1997	531	Approved: 14 Sept. 2004
Andorra	Amended: 24 April 2013	In force: 18 Oct. 2010	808	In force: 19 Dec. 2011
Angola	In force: 28 April 2010	In force: 28 April 2010	800	In force: 28 April 2010
Antigua and Barbuda[2]	Amended: 5 March 2012	In force: 9 Sept. 1996	528	In force: 15 Nov. 2013
Argentina[3]		In force: 4 March 1994	435	
Armenia		In force: 5 May 1994	455	In force: 28 June 2004
Australia		In force: 10 July 1974	217	In force: 12 Dec. 1997
Austria[4]		Accession: 31 July 1996	193	In force: 30 April 2004
Azerbaijan	Rescinded: 15 July 2015	In force: 29 April 1999	580	In force: 29 Nov. 2000
Bahamas[2]	Amended: 25 July 2007	In force: 12 Sept. 1997	544	
Bahrain	In force: 10 May 2009	In force: 10 May 2009	767	In force: 20 July 2011
Bangladesh		In force: 11 June 1982	301	In force: 30 March 2001
Barbados[2]	X	In force: 14 Aug. 1996	527	
Belarus		In force: 2 Aug. 1995	495	Signed: 15 Nov. 2005
Belgium		In force: 21 Feb. 1977	193	In force: 30 April 2004
Belize[5]	X	In force: 21 Jan. 1997	532	
Benin	*Amended: 15 April 2008*	*Signed: 7 June 2005*		*Signed: 7 June 2005*
Bhutan	X	In force: 24 Oct. 1989	371	
Bolivia, Plurinational State of [2]	X	In force: 6 Feb. 1995	465	
Bosnia and Herzegovina		In force: 4 April 2013	851	In force: 3 July 2013
Botswana		In force: 24 Aug. 2006	694	In force: 24 Aug. 2006
Brazil[6]		In force: 4 March 1994	435	
Brunei Darussalam	X	In force: 4 Nov. 1987	365	
Bulgaria[7]		Accession: 1 May 2009	193	Accession: 1 May 2009
Burkina Faso	Amended: 18 Feb. 2008	In force: 17 April 2003	618	In force: 17 April 2003
Burundi	In force: 27 Sept. 2007	In force: 27 Sept. 2007	719	In force: 27 Sept. 2007
Cabo Verde	*Amended: 27 March 2006*	*Signed: 28 June 2005*		*Signed: 28 June 2005*
Cambodia	Amended: 16 July 2014	In force: 17 Dec. 1999	586	In force: 24 April 2015
Cameroon	X	In force: 17 Dec. 2004	641	Signed: 16 Dec. 2004

Table A6. Conclusion of safeguards agreements, additional protocols and small quantities protocols (as of 31 December 2015) (cont.)

State [a]	Small quantities protocols [b]	Safeguards agreements [c]	INFCIRC	Additional protocols
Canada		In force: 21 Feb. 1972	164	In force: 8 Sept. 2000
Central African Republic	In force: 7 Sept. 2009	In force: 7 Sept. 2009	777	In force: 7 Sept. 2009
Chad	In force: 13 May 2010	In force: 13 May 2010	802	In force: 13 May 2010
Chile[8]		In force: 5 April 1995	476	In force: 3 Nov. 2003
China		In force: 18 Sept. 1989	369*	In force: 28 March 2002
Colombia[8]		In force: 22 Dec. 1982	306	In force: 5 March 2009
Comoros	In force: 20 Jan. 2009	In force: 20 Jan. 2009	752	In force: 20 Jan. 2009
Congo	In force: 28 Oct. 2011	In force: 28 Oct. 2011	831	In force: 28 Oct. 2011
Costa Rica[2]	Amended: 12 Jan. 2007	In force: 22 Nov. 1979	278	In force: 17 June 2011
Côte d'Ivoire		In force: 8 Sept. 1983	309	Signed: 22 Oct. 2008
Croatia	Amended: 26 May 2008	In force: 19 Jan. 1995	463	In force: 6 July 2000
Cuba[2]		In force: 3 June 2004	633	In force: 3 June 2004
Cyprus[9]		Accession: 1 May 2008	193	Accession: 1 May 2008
Czech Republic[10]		Accession: 1 Oct. 2009	193	Accession: 1 Oct. 2009
Dem. Rep. of the Congo		In force: 9 Nov. 1972	183	In force: 9 April 2003
Denmark[11]		In force: 1 March 1972 In force: 21 Feb. 1977	176 193	In force: 22 March 2013 In force: 30 April 2004
Djibouti	In force: 26 May 2015	In force: 26 May 2015	884	In force: 26 May 2015
Dominica[5]	X	In force: 3 May 1996	513	
Dominican Republic[2]	Amended: 11 Oct. 2006	In force: 11 Oct. 1973	201	In force: 5 May 2010
Dem. People's Rep. of Korea		In force: 10 April 1992	403	
Ecuador[2]	Amended: 7 April 2006	In force: 10 March 1975	231	In force: 24 Oct. 2001
Egypt		In force: 30 June 1982	302	
El Salvador[2]	Amended: 10 June 2011	In force: 22 April 1975	232	In force: 24 May 2004
Equatorial Guinea *Eritrea*	Approved: 13 June 1986	*Approved: 13 June 1986*		
Estonia[12]		Accession: 1 Dec. 2005	193	Accession: 1 Dec. 2005
Ethiopia	X	In force: 2 Dec. 1977	261	
Fiji	X	In force: 22 March 1973	192	In force: 14 July 2006
Finland[13]		Accession: 1 Oct. 1995	193	In force: 30 April 2004

Table A6. Conclusion of safeguards agreements, additional protocols and small quantities protocols (as of 31 December 2015) (cont.)

State [a]	Small quantities protocols [b]	Safeguards agreements [c]	INFCIRC	Additional protocols
France		In force: 12 Sept. 1981	290*	In force: 30 April 2004
	X	In force: 26 Oct. 2007[14]	718	
Gabon	Amended: 30 Oct. 2013	In force: 25 March 2010	792	In force: 25 March 2010
Gambia	Amended: 17 Oct. 2011	In force: 8 Aug. 1978	277	In force: 18 Oct. 2011
Georgia		In force: 3 June 2003	617	In force: 3 June 2003
Germany[15]		In force: 21 Feb. 1977	193	In force: 30 April 2004
Ghana	Rescinded: 24 Feb. 2012	In force: 17 Feb. 1975	226	In force: 11 June 2004
Greece[16]		Accession: 17 Dec. 1981	193	In force: 30 April 2004
Grenada[2]	X	In force: 23 July 1996	525	
Guatemala[2]	Amended: 26 April 2011	In force: 1 Feb. 1982	299	In force: 28 May 2008
Guinea	*Signed: 13 Dec. 2011*	*Signed: 13 Dec. 2011*		*Signed: 13 Dec. 2011*
Guinea-Bissau	*Signed: 21 June 2013*	*Signed: 21 June 2013*		*Signed: 21 June 2013*
Guyana[2]	X	In force: 23 May 1997	543	
Haiti[2]	X	In force: 9 March 2006	681	In force: 9 March 2006
Holy See	Amended: 11 Sept. 2006	In force: 1 Aug. 1972	187	In force: 24 Sept. 1998
Honduras[2]	Amended: 20 Sept. 2007	In force: 18 April 1975	235	Signed: 7 July 2005
Hungary[17]		Accession: 1 July 2007	193	Accession: 1 July 2007
Iceland	Amended: 15 March 2010	In force: 16 Oct. 1974	215	In force: 12 Sept. 2003
India		In force: 30 Sept. 1971	211	
		In force: 17 Nov. 1977	260	
		In force: 27 Sept. 1988	360	
		In force: 11 Oct. 1989	374	
		In force: 1 March 1994	433	
		In force: 11 May 2009	754	In force: 25 July 2014
Indonesia		In force: 14 July 1980	283	In force: 29 Sept. 1999
Iran, Islamic Republic of		In force: 15 May 1974	214	Signed: 18 Dec. 2003
Iraq		In force: 29 Feb. 1972	172	In force: 10 Oct. 2012
Ireland		In force: 21 Feb. 1977	193	In force: 30 April 2004
Israel		In force: 4 April 1975	249/Add.1	
Italy		In force: 21 Feb. 1977	193	In force: 30 April 2004
Jamaica[2]	Rescinded: 15 Dec. 2006	In force: 6 Nov. 1978	265	In force: 19 March 2003

Table A6. Conclusion of safeguards agreements, additional protocols and small quantities protocols (as of 31 December 2015) (cont.)

State [a]	Small quantities protocols [b]	Safeguards agreements [c]	INFCIRC	Additional protocols
Japan		In force: 2 Dec. 1977	255	In force: 16 Dec. 1999
Jordan	Rescinded: 24 Apr. 2015	In force: 21 Feb. 1978	258	In force: 28 July 1998
Kazakhstan		In force: 11 Aug. 1995	504	In force: 9 May 2007
Kenya	In force: 18 Sept. 2009	In force: 18 Sept. 2009	778	In force: 18 Sept. 2009
Kiribati	X	In force: 19 Dec. 1990	390	Signed: 9 Nov. 2004
Korea, Republic of		In force: 14 Nov. 1975	236	In force: 19 Feb. 2004
Kuwait	Amended: 26 July 2013	In force: 7 March 2002	607	In force: 2 June 2003
Kyrgyzstan	X	In force: 3 Feb. 2004	629	In force: 10 Nov. 2011
Lao People's Dem. Rep.	X	In force: 5 April 2001	599	Signed: 5 Nov. 2014
Latvia[18]		Accession: 1 Oct. 2008	193	Accession: 1 Oct. 2008
Lebanon	Amended: 5 Sept. 2007	In force: 5 March 1973	191	
Lesotho	Amended: 8 Sept. 2009	In force: 12 June 1973	199	In force: 26 April 2010
Liberia				
Libya		In force: 8 July 1980	282	In force: 11 Aug. 2006
Liechtenstein		In force: 4 Oct. 1979	275	In force: 25 Nov. 2015
Lithuania[19]		Accession: 1 Jan. 2008	193	Accession: 1 Jan. 2008
Luxembourg		In force: 21 Feb. 1977	193	In force: 30 April 2004
Madagascar	Amended: 29 May 2008	In force: 14 June 1973	200	In force: 18 Sept. 2003
Malawi	Amended: 29 Feb. 2008	In force: 3 Aug. 1992	409	In force: 26 July 2007
Malaysia		In force: 29 Feb. 1972	182	Signed: 22 Nov. 2005
Maldives	X	In force: 2 Oct. 1977	253	
Mali	Amended: 18 April 2006	In force: 12 Sept. 2002	615	In force: 12 Sept. 2002
Malta[20]		Accession: 1 July 2007	193	Accession: 1 July 2007
Marshall Islands		In force: 3 May 2005	653	In force: 3 May 2005
Mauritania	Amended: 20 March 2013	In force: 10 Dec. 2009	788	In force: 10 Dec. 2009
Mauritius	Amended: 26 Sept. 2008	In force: 31 Jan. 1973	190	In force: 17 Dec. 2007
Mexico[21]		In force: 14 Sept. 1973	197	In force: 4 March 2011
Micronesia, Federated States of	*Signed: 1 June 2015*	*Signed: 1 June 2015*		
Monaco	Amended: 27 Nov. 2008	In force: 13 June 1996	524	In force: 30 Sept. 1999
Mongolia	X	In force: 5 Sept. 1972	188	In force: 12 May 2003
Montenegro	In force: 4 March 2011	In force: 4 March 2011	814	In force: 4 March 2011

Table A6. Conclusion of safeguards agreements, additional protocols and small quantities protocols (as of 31 December 2015) (cont.)

State [a]	Small quantities protocols [b]	Safeguards agreements [c]	INFCIRC	Additional protocols
Morocco	Rescinded: 15 Nov. 2007	In force: 18 Feb. 1975	228	In force: 21 April 2011
Mozambique	In force: 1 March 2011	In force: 1 March 2011	813	In force: 1 March 2011
Myanmar	X	In force: 20 April 1995	477	Signed: 17 Sept. 2013
Namibia	X	In force: 15 April 1998	551	In force: 20 Feb. 2012
Nauru	X	In force: 13 April 1984	317	
Nepal	X	In force: 22 June 1972	186	
Netherlands	X	In force: 5 June 1975 [14]	229	
		In force: 21 Feb. 1977	193	In force: 30 April 2004
New Zealand[22]	Amended: 24 Feb. 2014	In force: 29 Feb. 1972	185	In force: 24 Sept. 1998
Nicaragua[2]	Amended: 12 June 2009	In force: 29 Dec. 1976	246	In force: 18 Feb. 2005
Niger		In force: 16 Feb. 2005	664	In force: 2 May 2007
Nigeria	Rescinded: 14 Aug. 2012	In force: 29 Feb. 1988	358	In force: 4 April 2007
Norway		In force: 1 March 1972	177	In force: 16 May 2000
Oman	X	In force: 5 Sept. 2006	691	
Pakistan		In force: 5 March 1962	34	
		In force: 17 June 1968	116	
		In force: 17 Oct. 1969	135	
		In force: 18 March 1976	239	
		In force: 2 March 1977	248	
		In force: 10 Sept. 1991	393	
		In force: 24 Feb. 1993	418	
		In force: 22 Feb. 2007	705	
		In force: 15 April 2011	816	
Palau	Amended: 15 March 2006	In force: 13 May 2005	650	In force: 13 May 2005
Palestine				
Panama[8]	Amended: 4 March 2011	In force: 23 March 1984	316	In force: 11 Dec. 2001
Papua New Guinea	X	In force: 13 Oct. 1983	312	
Paraguay[2]	X	In force: 20 March 1979	279	In force: 15 Sept. 2004
Peru[2]		In force: 1 Aug. 1979	273	In force: 23 July 2001
Philippines		In force: 16 Oct. 1974	216	In force: 26 Feb. 2010
Poland[23]		Accession: 1 March 2007	193	Accession: 1 March 2007

Table A6. Conclusion of safeguards agreements, additional protocols and small quantities protocols (as of 31 December 2015) (cont.)

State [a]	Small quantities protocols [b]	Safeguards agreements [c]	INFCIRC	Additional protocols
Portugal[24]		Accession: 1 July 1986	193	In force: 30 April 2004
Qatar	In force: 21 Jan. 2009	In force: 21 Jan. 2009	747	
Republic of Moldova	Amended: 1 Sept. 2011	In force: 17 May 2006	690	In force: 1 June 2012
Romania[25]		Accession: 1 May 2010	193	Accession: 1 May 2010
Russian Federation		In force: 10 June 1985	327*	In force: 16 Oct. 2007
Rwanda	In force: 17 May 2010	In force: 17 May 2010	801	In force: 17 May 2010
Saint Kitts and Nevis[5]	X	In force: 7 May 1996	514	In force: 19 May 2014
Saint Lucia[5]	X	In force: 2 Feb. 1990	379	
St Vincent and the Grenadines[5]	X	In force: 8 Jan. 1992	400	
Samoa	X	In force: 22 Jan. 1979	268	
San Marino	Amended: 13 May 2011	In force: 21 Sept. 1998	575	
São Tomé and Príncipe				
Saudi Arabia	X	In force: 13 Jan. 2009	746	
Senegal	Amended: 6 Jan. 2010	In force: 14 Jan. 1980	276	Signed: 15 Dec. 2006
Serbia[26]		In force: 28 Dec. 1973	204	Signed: 3 July 2009
Seychelles	Amended: 31 Oct. 2006	In force: 19 July 2004	635	In force: 13 Oct. 2004
Sierra Leone	X	In force: 4 Dec. 2009	787	
Singapore	Amended: 31 March 2008	In force: 18 Oct. 1977	259	In force: 31 March 2008
Slovakia[27]		Accession: 1 Dec. 2005	193	Accession: 1 Dec. 2005
Slovenia[28]		Accession: 1 Sept. 2006	193	Accession: 1 Sept. 2006
Solomon Islands	X	In force: 17 June 1993	420	
Somalia				
South Africa		In force: 16 Sept. 1991	394	In force: 13 Sept. 2002
Spain		Accession: 5 April 1989	193	In force: 30 April 2004
Sri Lanka		In force: 6 Aug. 1984	320	
Sudan	X	In force: 7 Jan. 1977	245	
Suriname[2]	X	In force: 2 Feb. 1979	269	
Swaziland	Amended: 23 July 2010	In force: 28 July 1975	227	In force: 8 Sept. 2010
Sweden[29]		Accession: 1 June 1995	193	In force: 30 April 2004
Switzerland		In force: 6 Sept. 1978	264	In force: 1 Feb. 2005
Syrian Arab Republic		In force: 18 May 1992	407	

Table A6. Conclusion of safeguards agreements, additional protocols and small quantities protocols (as of 31 December 2015) (cont.)

State [a]	Small quantities protocols [b]	Safeguards agreements [c]	INFCIRC	Additional protocols
Tajikistan	Rescinded: 6 Nov. 2015	In force: 14 Dec. 2004	639	In force: 14 Dec. 2004
Thailand		In force: 16 May 1974	241	Signed: 22 Sept. 2005
The fYR of Macedonia	Amended: 9 July 2009	In force: 16 April 2002	610	In force: 11 May 2007
Timor-Leste	*Signed: 6 Oct. 2009*	*Signed: 6 Oct. 2009*		*Signed: 6 Oct. 2009*
Togo	Amended: 8 Oct. 2015	In force: 18 July 2012	840	In force: 18 July 2012
Tonga	X	In force: 18 Nov. 1993	426	
Trinidad and Tobago[2]	X	In force: 4 Nov. 1992	414	
Tunisia		In force: 13 March 1990	381	Signed: 24 May 2005
Turkey		In force: 1 Sept. 1981	295	In force: 17 July 2001
Turkmenistan		In force: 3 Jan. 2006	673	In force: 3 Jan. 2006
Tuvalu	X	In force: 15 March 1991	391	
Uganda	Amended: 24 June 2009	In force: 14 Feb. 2006	674	In force: 14 Feb. 2006
Ukraine		In force: 22 Jan. 1998	550	In force: 24 Jan. 2006
United Arab Emirates	X	In force: 9 Oct. 2003	622	In force: 20 Dec. 2010
United Kingdom	X	In force: 14 Dec. 1972[30] In force: 14 Aug. 1978 Signed: 6 Jan. 1993[14]	175 263*	In force: 30 April 2004
United Republic of Tanzania	Amended: 10 June 2009	In force: 7 Feb. 2005	643	In force: 7 Feb. 2005
United States of America	X	In force: 9 Dec. 1980 In force: 6 April 1989[14]	288* 366	In force: 6 Jan. 2009
Uruguay[2]		In force: 17 Sept. 1976	157	In force: 30 April 2004
Uzbekistan		In force: 8 Oct. 1994	508	In force: 21 Dec. 1998
Vanuatu	In force: 21 May 2013	In force: 21 May 2013	852	In force: 21 May 2013
Venezuela, Bolivarian Republic of [2]		In force: 11 March 1982	300	
Viet Nam		In force: 23 Feb. 1990	376	In force: 17 Sept. 2012
Yemen	X	In force: 14 Aug. 2002	614	
Zambia	X	In force: 22 Sept. 1994	456	Signed: 13 May 2009
Zimbabwe	Amended: 31 Aug. 2011	In force: 26 June 1995	483	

Key	
Bold	States not party to the Treaty of the Non-Proliferation of Nuclear Weapons (NPT) whose safeguards agreements are of INFCIRC/66-type.
Italics	States Parties to the NPT that have not yet brought into force comprehensive safeguards agreements (CSAs) pursuant to Article III of the NPT.
*	Voluntary offer safeguards agreement with NPT nuclear-weapon States.
X	'X' in the 'small quantities protocols' column indicates that the State has an operative small quantities protocol (SQP). 'Amended' indicates that the operative SQP is based on the revised SQP standardized text.
NB:	This table does not aim at listing all safeguards agreements that the Agency has concluded. Not included are agreements under which the application of safeguards has been suspended upon the entry into force of a CSA. Unless otherwise indicated, the safeguards agreements referred to are CSAs concluded pursuant to the NPT.

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

[b] Provided that they meet certain eligibility criteria (including that the quantities of nuclear material do not exceed the limits set out in paragraph 37 of INFCIRC/153(Corrected)), countries have the option to conclude an SQP to their CSAs that holds in abeyance the implementation of most of the detailed provisions set out in Part II of the CSAs as long as eligibility criteria continue to apply. This column contains countries whose CSA with an SQP based on the original standard text has been approved by the Board of Governors and for which, as far as the Secretariat is aware, these eligibility criteria continue to apply. For those States that have accepted the revised standard SQP text (approved by the Board of Governors on 20 September 2005) the current status is reflected.

[c] The Agency also applies safeguards for Taiwan, China, under two agreements, which entered into force on 13 October 1969 (INFCIRC/133) and 6 December 1971 (INFCIRC/158), respectively.

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[1] *Sui generis* comprehensive safeguards agreement. On 28 November 2002, upon approval by the Board of Governors, an exchange of letters entered into force confirming that the safeguards agreement satisfies the requirement of Article III of the NPT.

[2] Safeguards agreement is pursuant to both the Treaty of Tlatelolco and the NPT.

[3] Date refers to the safeguards agreement concluded between Argentina, Brazil, ABACC and the Agency. On 18 March 1997, upon approval by the Board of Governors, an exchange of letters entered into force between Argentina and the Agency confirming that the safeguards agreement satisfies the requirements of Article 13 of the Treaty of Tlatelolco and Article III of the NPT to conclude a safeguards agreement with the Agency.

[4] The application of safeguards for Austria under the NPT bilateral safeguards agreement (INFCIRC/156), in force since 23 July 1972, was suspended on 31 July 1996, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Austria had acceded, entered into force for Austria.

[5] Date refers to a safeguards agreement pursuant to Article III of the NPT. Upon approval by the Board of Governors, an exchange of letters entered into force (for Saint Lucia on 12 June 1996 and for Belize, Dominica, Saint Kitts and Nevis and Saint Vincent and the Grenadines on 18 March 1997) confirming that the safeguards agreement satisfies the requirement of Article 13 of the Treaty of Tlatelolco.

[6] Date refers to the safeguards agreement concluded between Argentina, Brazil, ABACC and the Agency. On 10 June 1997, upon approval by the Board of Governors, an exchange of letters entered into force between Brazil and the Agency confirming that the safeguards agreement satisfies the requirement of Article 13 of the Treaty of Tlatelolco. On 20 September 1999, upon approval by the Board of Governors, an exchange of letters entered into force confirming that the safeguards agreement also satisfies the requirement of Article III of the NPT.

[7] The application of safeguards for Bulgaria under the NPT bilateral safeguards agreement (INFCIRC/178), in force since 29 February 1972, was suspended on 1 May 2009, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Bulgaria had acceded, entered into force for Bulgaria.

[8] Date refers to a safeguards agreement pursuant to Article 13 of the Treaty of Tlatelolco. Upon approval by the Board of Governors, an exchange of letters entered into force (for Chile on 9 September 1996; for Colombia on 13 June 2001; for Panama on 20 November 2003) confirming that the safeguards agreement satisfies the requirement of Article III of the NPT.

[9] The application of safeguards for Cyprus under the NPT bilateral safeguards agreement (INFCIRC/189), in force since 26 January 1973, was suspended on 1 May 2008, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Cyprus had acceded, entered into force for Cyprus.

[10] The application of safeguards for the Czech Republic under the NPT bilateral safeguards agreement (INFCIRC/541), in force since 11 September 1997, was suspended on 1 October 2009, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which the Czech Republic had acceded, entered into force for the Czech Republic.

[11] The application of safeguards for Denmark under the NPT bilateral safeguards agreement (INFCIRC/176), in force since 1 March 1972, was suspended on 21 February 1977, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193) entered into force for Denmark. Since 21 February 1977, INFCIRC/193 also applies to the Faroe Islands. Upon Greenland's secession from Euratom as of 31 January 1985, INFCIRC/176 re-entered into force for Greenland. The Additional Protocol for Greenland entered into force on 22 March 2013 (INFCIRC/176/Add.1).

[12] The application of safeguards for Estonia under the NPT bilateral safeguards agreement (INFCIRC/547), in force since 24 November 1997, was suspended on 1 December 2005, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Estonia had acceded, entered into force for Estonia.

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

[14] The safeguards agreement is pursuant to Additional Protocol I to the Treaty of Tlatelolco.

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

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

[17] The application of safeguards for Hungary under the NPT bilateral safeguards agreement (INFCIRC/174), in force since 30 March 1972, was suspended on 1 July 2007, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Hungary had acceded, entered into force for Hungary.

[18] The application of safeguards for Latvia under the NPT bilateral safeguards agreement (INFCIRC/434), in force since 21 December 1993, was suspended on 1 October 2008, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Latvia had acceded, entered into force for Latvia.

[19] The application of safeguards for Lithuania under the NPT bilateral safeguards agreement (INFCIRC/413), in force since 15 October 1992, was suspended on 1 January 2008, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Lithuania had acceded, entered into force for Lithuania.

[20] The application of safeguards for Malta under the NPT bilateral safeguards agreement (INFCIRC/387), in force since 13 November 1990, was suspended on 1 July 2007, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Malta had acceded, entered into force for Malta.

[21] The safeguards agreement was concluded pursuant to both the Treaty of Tlatelolco and the NPT. The application of safeguards under an earlier safeguards agreement pursuant to the Treaty of Tlatelolco, which entered into force on 6 September 1968 (INFCIRC/118), was suspended as of 14 September 1973.

[22] Whereas the NPT safeguards agreement and SQP with New Zealand (INFCIRC/185) also apply to Cook Islands and Niue, the additional protocol thereto (INFCIRC/185/Add.1) does not apply to those territories. Amendments to the SQP entered into force only for New Zealand on 24 February 2014 (INFCIRC/185/Mod.1).

[23] The application of safeguards for Poland under the NPT bilateral safeguards agreement (INFCIRC/179), in force since 11 October 1972, was suspended on 1 March 2007, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Poland had acceded, entered into force for Poland.

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

[25] The application of safeguards for Romania under the NPT bilateral safeguards agreement (INFCIRC/180), in force since 27 October 1972, was suspended on 1 May 2010, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Romania had acceded, entered into force for Romania.

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

[27] The application of safeguards for Slovakia under the NPT bilateral safeguards agreement with the Czechoslovak Socialist Republic (INFCIRC/173), in force since 3 March 1972, was suspended on 1 December 2005, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Slovakia had acceded, entered into force for Slovakia.

[28] The application of safeguards for Slovenia under the NPT bilateral safeguards agreement (INFCIRC/538), in force since 1 August 1997, was suspended on 1 September 2006, on which date the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Slovenia had acceded, entered into force for Slovenia.

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

[30] Date refers to the INFCIRC/66-type safeguards agreement, concluded between the United Kingdom and the Agency, which remains in force.

Table A7. Participation in multilateral treaties for which the Director General is depositary, conclusion of Revised Supplementary Agreements and acceptance of amendments to Articles VI and XIV.A of the Agency's Statute (status as of 31 December 2015)

	State/Organization	P&I	VC	CPPNM	CPPNM-AM	ENC	AC	JP	NS	RADW	PAVC	CSC	RSA	VI	XIV.A
*	Afghanistan			P		Sr	Sr						P	X	
*	Albania	P		P	CS	P	P		P	P			P	X	X
*	Algeria			Pr	CS	Pr	Pr		S				P	X	X
	Andorra			Pr											
*	Angola					P							P		
*	Antigua and Barbuda			P	CS										
*	Argentina	P	P	Pr	CS	Pr	Pr	S	P	P	P	P	P	X	X
*	Armenia		P	P	CS	P	P		P	P			P		
*	Australia	P		P	CS	Pr	Pr		P	P		S			X
*	Austria			Pr	CS	P	Pr		Pr	P				X	X
*	Azerbaijan			Pr									P		
*	Bahamas			Pr		S									
*	Bahrain			Pr	CS	Pr			P				P		
*	Bangladesh			P		P	P		P				P		
*	Barbados														
*	Belarus	Pr	P	Pr		Pr	Pr		P	P	P		P	X	X
*	Belgium	Pr		Pr	CSr	P	P	S	P	P					
*	Belize												P		
*	Benin	P											P		
	Bhutan														
*	Bolivia, Plurinational State of	P	P	P		Pr	Pr						P		
*	Bosnia and Herzegovina	Pr	P	P	CS	P	P		P	P	P		P	X	X
*	Botswana			P	CS	P	P			P			P		
*	Brazil	P	P	P		P	P		P	P			P	X	X
*	Brunei Darussalam														
*	Bulgaria	Pr	P	P	CS	P	P	P	P	P			P	X	X

Table A7. Participation in multilateral treaties for which the Director General is depositary, conclusion of Revised Supplementary Agreements and acceptance of amendments to Articles VI and XIV.A of the Agency's Statute (status as of 31 December 2015) (cont.)

	State/Organization	P&I	VC	CPPNM	CPPNM-AM	ENC	AC	JP	NS	RADW	PAVC	CSC	RSA	VI	XIV.A
*	Burkina Faso			P	CS	P	P						P		
*	Burundi												P		
	Cabo Verde			P											
*	Cambodia			P		P			P				P		
*	Cameroon	P	P	P		P	P	P					P		
*	Canada	Pr		P	CSr	Pr	Pr		P	P		S		X	X
*	Central African Republic			P											
*	Chad												P		
*	Chile	Pr	Pr	P	CS	P	P	P	P	P			P		
*	China	Pr		Pr	CS	Pr	Pr		P	Pr			P		
*	Colombia	P	S	P	CS	P	Pr						P	X	X
	Comoros			P											
*	Congo														
*	Costa Rica			P		P	P						P		
*	Côte d'Ivoire			P		S	S						P		
*	Croatia	P	P	P	CS	P	P	P	P	P			P	X	X
*	Cuba	Pr	P	Pr	CS	Pr	Pr		S				P		
*	Cyprus	P		Pr	CS	P	P		P	P			P	X	X
*	Czech Republic	P	P	P	CS	P	P	P	P	P	S	S	P	X	X
	Dem. People's Rep. of Korea					Sr	Sr								
*	Dem. Rep. of the Congo	P		P		S	S						P		
*	Denmark	Pr		P	CSr	P	Pr	P	Pr	Pr				X	X
*	Djibouti			P	CS										
*	Dominica			P											
*	Dominican Republic			P	CS	P							P		
*	Ecuador	P		P									P		

Table A7. Participation in multilateral treaties for which the Director General is depositary, conclusion of Revised Supplementary Agreements and acceptance of amendments to Articles VI and XIV.A of the Agency's Statute (status as of 31 December 2015) (cont.)

	State/Organization	P&I	VC	CPPNM	CPPNM-AM	ENC	AC	JP	NS	RADW	PAVC	CSC	RSA	VI	XIV.A
*	Egypt	P	P			Pr	Pr	P	S				P		
*	El Salvador			Pr		Pr	Pr						P	X	
	Equitorial Guinea			P											
*	Eritrea														
*	Estonia	P	P	P	CS	P	P	P	P	P			P	X	X
*	Ethiopia												P	X	
*	Fiji			P	CS								P		
*	Finland	P		Pr	CS	P	Pr	P	P	P				X	X
*	France			Pr	CS	Pr	Pr	Pr	P	P				X	X
*	Gabon			P	CS	P	P			P			P		
	Gambia														
*	Georgia			P	CS	P				P			P		
*	Germany	Pr		Pr	CS	Pr	Pr	P	P	P				X	X
*	Ghana	P		P	CS				P	P			P		
*	Greece	P		Pr	CS	Pr	Pr	P	P	P			P	X	X
	Grenada			P											
*	Guatemala			Pr		P	P						P		
	Guinea			P											
	Guinea-Bissau			P											
*	Guyana			P											
*	Haiti			S									P		
*	Holy See	P				S	S							X	X
*	Honduras			P									P		
*	Hungary	Pr	P	P	CS	P	P	P	P	P	S		P	X	X
*	Iceland	P		P	CS	P	P		P	P			P	X	X
*	India	P		Pr	CS	Pr	Pr		P			S			

Table A7. Participation in multilateral treaties for which the Director General is depositary, conclusion of Revised Supplementary Agreements and acceptance of amendments to Articles VI and XIV.A of the Agency's Statute (status as of 31 December 2015) (cont.)

	State/Organization	P&I	VC	CPPNM	CPPNM-AM	ENC	AC	JP	NS	RADW	PAVC	CSC	RSA	VI	XIV.A
*	Indonesia	Pr		Pr	CS	Pr	Pr		P	P	S	S	P		
*	Iran, Islamic Republic of	P				Pr	Pr						P		X
*	Iraq	P		P		Pr	Pr						P		
*	Ireland	P		Pr	CS	P	Pr		P	P			P	X	X
*	Israel		Sr	Pr	CSr	Pr	Pr		S				P	X	
*	Italy	Pr		Pr	CS	Pr	Pr	P	P	P	S	S		X	X
*	Jamaica	P		P	CS								P		
*	Japan	P		P	CS	P	Pr		P	Pr		Pr		X	X
*	Jordan	Pr	P	Pr	CS	P	P		P		Pr		P		
*	Kazakhstan	P	P	P	CS	P	P		P	P	P		P		
*	Kenya			P	CS								P		X
	Kiribati														
*	Korea, Republic of	Pr		Pr	CS	P	Pr		P	P			P	X	X
*	Kuwait	P		Pr		P	P		P				P		
*	Kyrgyzstan			P						P			P		
*	Lao People's Dem. Rep.			Pr		P	P						P		
*	Latvia	P	P	P	CS	P	P	P	P	P	P		P	X	X
*	Lebanon		P	P		P	P		P	S	S	S	P		
*	Lesotho			P	CS	P	P						P		
*	Liberia														
*	Libya			P	CS	P	P		P				P	X	
*	Liechtenstein			P	CS	P	P							X	X
*	Lithuania	P	P	P	CS	P	P	P	P	P	S	S	P	X	X
*	Luxembourg	Pr		Pr	CS	P	P		P	P				X	X
*	Madagascar			P									P		
*	Malawi			P									P		

Table A7. Participation in multilateral treaties for which the Director General is depositary, conclusion of Revised Supplementary Agreements and acceptance of amendments to Articles VI and XIV.A of the Agency's Statute (status as of 31 December 2015) (cont.)

	State/Organization	P&I	VC	CPPNM	CPPNM-AM	ENC	AC	JP	NS	RADW	PAVC	CSC	RSA	VI	XIV.A
*	Malaysia					Pr	Pr						P		
	Maldives														
*	Mali			P	CS	P	P		P				P		
*	Malta			P	CS				P	P			P	X	X
*	Marshall Islands			P											
*	Mauritania			P	CS	P	P			P			P		
*	Mauritius	P	P			Pr	Pr			P		S	P		
*	Mexico	Pr	P	P	CS	P	P		P				P	X	X
	Micronesia														
*	Monaco			P		Pr	Pr		S					X	X
*	Mongolia	P		P		P	P						P		
*	Montenegro	P	P	P		P	P		P	P	P	P	P		
*	Morocco	Pr	S	P	CS	P	P	S	S	P	P	P	P	X	
*	Mozambique	P		Pr		P	P						P		
*	Myanmar					Pr							P	X	X
*	Namibia			P									P		
	Nauru			P	CS										
*	Nepal												P		
*	Netherlands	Pr		Pr	CS	Pr	Pr	P	P	P				X	X
*	New Zealand	P		P		P	Pr								
*	Nicaragua	P		P		Pr	Pr		S				P		
*	Niger	P	P	P	CS	S	S				CS		P		
*	Nigeria	P	P	P	CS	P	P		P	P			P		
	Niue			P											
*	Norway	P		Pr	CS	P	Pr	P	P	P				X	X
*	Oman	Pr		Pr		Pr	Pr		P	P			P		

Table A7. Participation in multilateral treaties for which the Director General is depositary, conclusion of Revised Supplementary Agreements and acceptance of amendments to Articles VI and XIV.A of the Agency's Statute (status as of 31 December 2015) (cont.)

	State/Organization	P&I	VC	CPPNM	CPPNM-AM	ENC	AC	JP	NS	RADW	PAVC	CSC	RSA	VI	XIV.A
*	Pakistan	Pr		Pr		Pr	Pr		P				P	X	X
*	Palau	P		P									P		
*	Panama			P		P	P						P	X	
*	Papua New Guinea														
*	Paraguay			P		P	P		P				P		
*	Peru		P	Pr	CS	Pr	Pr		P	S	S	S	P	X	X
*	Philippines	P	P	P		P	P	S	S	S	S	S	P		
*	Poland	P	P	P	CS	P	P	P	P	P	P		P	X	X
*	Portugal	Pr		Pr	CS	P	P	S	P	P			P	X	X
*	Qatar			Pr	CS	P	P						P		
*	Republic of Moldova	Pr	P	P	CS	P	P		P	Pr			P	X	X
*	Romania	Pr	P	Pr	CS	Pr	Pr	P	P	P	P	P	P	X	X
*	Russian Federation	Pr	P	P	CS	Pr	Pr		P	P					
*	Rwanda			P									P		
	Saint Kitts and Nevis			P											
	Saint Lucia			Pr	CS										
	St Vincent and the Grenadines		P			P	P	P							
	Samoa														
*	San Marino			P	CS										
	São Tomé and Príncipe														
*	Saudi Arabia		P	Pr	CS	Pr	Pr		P	P	Pr		P		
*	Senegal	P	P	P		P	P		P	P		S	P		
*	Serbia	P	P	P		P	P						P		
*	Seychelles			P	CS								P		X
*	Sierra Leone					S	S						P		
*	Singapore	Pr		Pr	CSr	P	P		P				P		

Table A7. Participation in multilateral treaties for which the Director General is depositary, conclusion of Revised Supplementary Agreements and acceptance of amendments to Articles VI and XIV.A of the Agency's Statute (status as of 31 December 2015) (cont.)

	State/Organization	P&I	VC	CPPNM	CPPNM-AM	ENC	AC	JP	NS	RADW	PAVC	CSC	RSA	VI	XIV.A
*	Slovakia	P	P	P	CS	Pr	Pr	P	P	P			P	X	X
*	Slovenia	P		P	CS	P	P	P	P	P			P	X	X
	Solomon Islands														
	Somalia														
*	South Africa	Pr		Pr		Pr	Pr		P	P			P	X	X
*	Spain	P	S	Pr	CS	Pr	Pr	S	P	P			P	X	X
*	Sri Lanka					Pr	Pr		P				P		
*	Sudan			P		S	S		S				P		
	Suriname														
*	Swaziland			P											
*	Sweden	P		Pr	CS	P	Pr	P	P	P				X	X
*	Switzerland	Pr		Pr	CS	P	P	S	P	P				X	X
*	Syrian Arab Republic	P				S	S		S				P		X
*	Tajikistan	P		P	CS	P	P			P			P		
*	Thailand	Pr				Pr	Pr						P		
*	The fYR of Macedonia		P	P	CS	P	P		P	P			P		
	Timor Leste														
*	Togo			P											
	Tonga			P											
*	Trinidad and Tobago		P	P											
*	Tunisia	P		P	CS	P	P		P				P	X	X
*	Turkey	Pr		Pr	CSr	Pr	Pr	P	P				P	X	X
	Turkmenistan			P	CS										
	Tuvalu														
*	Uganda			P									P		
*	Ukraine	Pr	P	P	CS	Pr	Pr	P	Pr	P	S	S	P	X	X

Table A7. Participation in multilateral treaties for which the Director General is depositary, conclusion of Revised Supplementary Agreements and acceptance of amendments to Articles VI and XIV.A of the Agency's Statute (status as of 31 December 2015) (cont.)

	State/Organization	P&I	VC	CPPNM	CPPNM-AM	ENC	AC	JP	NS	RADW	PAVC	CSC	RSA	VI	XIV.A
*	United Arab Emirates			P	CS	Pr	Pr	P	P	P	Pr	Pr	P		
*	United Kingdom	P	S	Pr	CS	Pr	Pr	S	P	P				X	X
*	United Republic of Tanzania			P		P	P						P		
*	United States of America			P	CSr	Pr	Pr		P	P		Pr			
*	Uruguay		P	P		P	P	P	P	P			P	X	
*	Uzbekistan			P	CS					P			P		
*	Vanuatu														
*	Venezuela, Bolivarian Republic of					Pr							P		
*	Viet Nam	P		Pr	CS	Pr	Pr		P	P			P		
*	Yemen			P											
*	Zambia												P		
*	Zimbabwe					S	S						P		
	Euratom			Pr	COr	Pr	Pr		Pr	P					
	FAO					Pr	Pr								
	WHO					Pr	Pr								
	WMO					Pr	Pr								

P&I	Agreement on the Privileges and Immunities of the IAEA
VC	Vienna Convention on Civil Liability for Nuclear Damage
CPPNM	Convention on the Physical Protection of Nuclear Material
CPPNM-AM	Amendment to the Convention on the Physical Protection of Nuclear Material (not yet in force)
ENC	Convention on Early Notification of a Nuclear Accident
AC	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
JP	Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention
NS	Convention on Nuclear Safety
RADW	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
PAVC	Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage

CSC	Convention on Supplementary Compensation for Nuclear Damage (not yet in force)
RSA	Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA
VI	Acceptance of Amendment to Article VI of the IAEA Statute, as informed by the depositary Government
XIV.A	Acceptance of Amendment to Article XIV.A of the IAEA Statute, as informed by the depositary Government
*	Agency Member State
P	Party
S	Signatory
r	Existing reservation/declaration
CS	Contracting State
CO	Contracting Organization
X	Accepting State

Table A8. Conventions negotiated and adopted under the auspices of the Agency and/or for which the Director General is the depositary (status and relevant developments)

Agreement on the Privileges and Immunities of the IAEA (reproduced in INFCIRC/9/Rev. 2). In 2015, the status of the Agreement remained unchanged with 84 Parties.
Convention on Early Notification of a Nuclear Accident (reproduced in INFCIRC/335). Entered into force on 27 October 1986. In 2015, the status of the Convention remained unchanged with 119 Parties.
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (reproduced in INFCIRC/336). Entered into force on 26 February 1987. In 2015, the status of the Convention remained unchanged with 112 Parties.
Convention on Nuclear Safety (reproduced in INFCIRC/449). Entered into force on 24 October 1996. In 2015, 1 State became a Party to the Convention. By the end of the year, there were 78 Parties.
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (reproduced in INFCIRC/546). Entered into force on 18 June 2001. In 2015, 1 State became a Party to the Convention. By the end of the year, there were 70 Parties.
Convention on the Physical Protection of Nuclear Material (reproduced in INFCIRC/274/Rev.1). Entered into force on 8 February 1987. In 2015, 2 States became Parties to the Convention. By the end of the year, there were 153 Parties.
Amendment to the Convention on the Physical Protection of Nuclear Material. Adopted on 8 July 2005. In 2015, 7 States and 1 Organization adhered to the Amendment. By the end of the year, there were 90 Contracting States and 1 Contracting Organization.
Vienna Convention on Civil Liability for Nuclear Damage (reproduced in INFCIRC/500). Entered into force on 12 November 1977. In 2015, the status of the Convention remained unchanged with 40 Parties.
Optional Protocol Concerning the Compulsory Settlement of Disputes (reproduced in INFCIRC/500/Add.3). Entered into force on 13 May 1999. In 2015, the status of the Protocol remained unchanged with 2 Parties.
Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (reproduced in INFCIRC/402). Entered into force on 27 April 1992. In 2015, the status of the Protocol remained unchanged with 28 Parties.
Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (reproduced in INFCIRC/566). Entered into force on 4 October 2003. In 2015, 1 State acceded to the Protocol. By the end of the year, there were 12 Parties and 1 Contracting State.
Convention on Supplementary Compensation for Nuclear Damage (reproduced in INFCIRC/567). In 2015, 2 States adhered to the Convention, which entered into force on 17 April 2015. By the end of the year, there were 7 Parties.
Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA (RSA). In 2015, 1 State concluded an RSA. By the end of the year, there were 125 States party to an RSA Agreement.
Fifth Agreement to Extend the 1987 Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA) (reproduced in INFCIRC/167/Add.23). Entered into force on 31 August 2011 with effect from 12 June 2012. In 2015, 1 State became a Party to the Agreement. By the end of the year, there were 17 Parties.
African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) (Fifth Extension) (reproduced in INFCIRC/377/Add.20). Entered into force on 4 April 2015. By the end of the year, there were 16 Parties.
Agreement to Extend the Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL) (reproduced in INFCIRC/582/Add.4). Entered into force on 5 September 2015. By the end of the year, there were 17 Parties.
Co-operative Agreement for Arab States in Asia for Research, Development and Training Related to Nuclear Science and Technology (ARASIA) (Second Extension) (reproduced in INFCIRC/613/Add.3). Entered into force on 29 July 2014. In 2015, the status of the Agreement remained unchanged with 8 Parties.
Agreement on the Establishment of the ITER International Fusion Energy Organization for the Joint Implementation of the ITER Project (reproduced in INFCIRC/702). Entered into force on 24 October 2007. In 2015, the status of the Agreement remained unchanged with 7 Parties.
Agreement on the Privileges and Immunities of the ITER International Fusion Energy Organization for the Joint Implementation of the ITER Project (reproduced in INFCIRC/703). Entered into force on 24 October 2007. In 2015, the status of the Agreement remained unchanged with 6 Parties.

Table A9. Nuclear power reactors in operation and under construction in the world (as of 31 December 2015) [a]

Country	Reactors in operation		Reactors under construction		Nuclear electricity supplied in 2015		Total operating experience through 2015	
	No. of units	Total MW(e)	No. of units	Total MW(e)	TW·h	% of total	Years	Months
Argentina	3	1 632	1	25	6.5	4.8	76	2
Armenia	1	375			2.6	34.5	41	8
Belarus			2	2 218				
Belgium	7	5 913			24.8	37.5	275	7
Brazil	2	1 884	1	1 245	13.9	2.8	49	3
Bulgaria	2	1 926			14.7	31.3	159	3
Canada	19	13 524			95.6	16.6	693	6
China	31	26 774	24	24 128	161.2	3.0	209	2
Czech Republic	6	3 930			25.3	32.5	146	10
Finland	4	2 752	1	1 600	22.3	33.7	147	4
France	58	63 130	1	1 630	419.0	76.3	2 048	4
Germany	8	10 799			86.8	14.1	816	7
Hungary	4	1 889			15.0	52.7	122	2
India	21	5 308	6	3 907	34.6	3.5	439	6
Iran, Islamic Republic of	1	915			3.2	1.3	4	4
Japan	43	40 290	2	2 650	4.3	0.5	1 739	0
Korea, Republic of	24	21 733	4	5 420	157.2	31.7	474	0
Mexico	2	1 440			11.2	6.8	47	11
Netherlands	1	482			3.9	3.7	71	0
Pakistan	3	690	2	630	4.3	4.4	64	8
Romania	2	1 300			10.7	17.3	27	11
Russian Federation	35	25 443	8	6 582	182.8	18.6	1 191	4
Slovakia	4	1 814	2	880	14.1	55.9	156	7
Slovenia	1	688			5.4	38.0	34	3
South Africa	2	1 860			11.0	4.7	62	3
Spain	7	7 121			54.8	20.3	315	1
Sweden	10	9 648			54.5	34.3	432	6
Switzerland	5	3 333			22.2	33.5	204	11
Ukraine	15	13 107	2	1 900	82.4	56.5	458	6
United Arab Emirates			4	5 380				
United Kingdom	15	8 918			63.9	18.9	1 559	7
United States of America	99	99 185	5	5 633	798.0	19.5	4 111	4
Total [b, c]	**441**	**382 855**	**67**	**66 428**	**2 441.3**		**16 536**	**7**

[a] Data are from the Agency's Power Reactor Information System (PRIS) *(http://www.iaea.org/pris).*

[b] Note: The total figures include the following data from Taiwan, China:
6 units, 5052 MW(e) in operation; 2 units, 2600 MW(e) under construction;
35.1 TW·h of nuclear electricity generation, representing 16.3% of the total electricity generated.

[c] The total operating experience also includes shutdown plants in Italy (80 years, 8 months), Kazakhstan (25 years, 10 months), Lithuania (43 years, 6 months) and Taiwan, China (206 years, 1 month).

Table A10. Member State participation in selected Agency activities

Member State	No. of research contracts and agreements	No. of Collaborating Centres	Services provided to Member States					
			ALMERA	Dosimetry audits for radiotherapy[a]	Plant irradiation services	QUANUM[b]	QUAADRIL[b]	QUATRO[b]
Afghanistan								
Albania				3				1
Algeria	10							
Angola	1			2				
Antigua and Barbuda				1				
Argentina	55		1					
Armenia	3			1				1
Australia	44	1	3					
Austria	16		2		1			
Azerbaijan	2			2				
Bahamas				1				
Bahrain				1				
Bangladesh	22			13		1		1
Barbados				1				
Belarus	4		1	11				2
Belgium	24		2				1	
Belize								
Benin	1							
Bolivia, Plurinational State of				5				1
Bosnia and Herzegovina	1		3	5			1	1
Botswana	1			1	1			
Brazil	58	1	3	3				1
Brunei Darussalam				1				
Bulgaria	9		2	2				2
Burkina Faso	7	1						
Burundi								
Cambodia				1				

Table A10. Member State participation in selected Agency activities (cont.)

Member State	No. of research contracts and agreements	No. of Collaborating Centres	Services provided to Member States					
			ALMERA	Dosimetry audits for radiotherapy[a]	Plant irradiation services	QUANUM[b]	QUAADRIL[b]	QUATRO[b]
Cameroon	6			2				
Canada	36		3					
Central African Republic								
Chad								
Chile	16			19		1		1
China	94		3	303				1
Colombia	9			52				
Congo								
Costa Rica	5	1	1	4				2
Côte d'Ivoire					2			
Croatia	11		2	7				1
Cuba	22		3	9				
Cyprus			1	2				1
Czech Republic	20		1					3
Dem. Rep. of the Congo								
Denmark	3		1					
Djibouti								
Dominica								
Dominican Republic				9				
Ecuador	2			12				
Egypt	25		1	12				
El Salvador				4				2
Eritrea								
Estonia	6		1	2				1
Ethiopia	7		1	1				
Fiji								
Finland	9		1					

Table A10. Member State participation in selected Agency activities (cont.)

Member State	No. of research contracts and agreements	No. of Collaborating Centres	Services provided to Member States					
			ALMERA	Dosimetry audits for radiotherapy[a]	Plant irradiation services	QUANUM[b]	QUAADRIL[b]	QUATRO[b]
France	42		5					
Gabon								
Georgia	4			5				1
Germany	63		3		1			
Ghana	12			3				
Greece	16		5	2				2
Guatemala	5			5				1
Guyana				1				
Haiti								
Holy See								
Honduras				5				1
Hungary	16	1	2	11				2
Iceland			1					
India	79	1	3	149				
Indonesia	28		1	15		1		3
Iran, Islamic Republic of	11		1	3				
Iraq	1		1	4	1			
Ireland			1					
Israel	5		1	8				8
Italy	56	2	8					
Jamaica	5		1	3				
Japan	52	1	1					
Jordan	8		1	2				
Kazakhstan	5		1	19				1
Kenya	15		1	4	2			
Korea, Republic of	41		2					
Kuwait	3		1					

Table A10. Member State participation in selected Agency activities (cont.)

Member State	No. of research contracts and agreements	No. of Collaborating Centres	Services provided to Member States					
			ALMERA	Dosimetry audits for radiotherapy[a]	Plant irradiation services	QUANUM[b]	QUAADRIL[b]	QUATRO[b]
Kyrgyzstan			1	1				
Lao People's Dem. Rep.					1			
Latvia	1		1	3				1
Lebanon	2		1	9				
Lesotho								
Liberia								
Libya				3				
Liechtenstein								
Lithuania	3		3	5				1
Luxembourg			1					
Madagascar	2		1	2	1			
Malawi								
Malaysia	24	1	1	23		1	1	1
Mali	2			1				
Malta				2				
Marshall Islands								
Mauritania				1				
Mauritius	3			1				
Mexico	23	1	3	59		1		1
Monaco								
Mongolia	5		1	1	1			1
Montenegro	2		1	1				1
Morocco	15		1	18				1
Mozambique	1							
Myanmar	3		1	3				
Namibia	2			1	1			
Nepal	1			4	1			

Table A10. Member State participation in selected Agency activities (cont.)

Member State	No. of research contracts and agreements	No. of Collaborating Centres	Services provided to Member States					
			ALMERA	Dosimetry audits for radiotherapy[a]	Plant irradiation services	QUANUM[b]	QUAADRIL[b]	QUATRO[b]
Netherlands	14	1	2					
New Zealand	7		1					
Nicaragua				1				
Niger	6							
Nigeria	5			8	1			
Norway	4		2					
Oman				1	2			
Pakistan	44		1	13				1
Palau								
Panama	1		1	4				1
Papua New Guinea				1				
Paraguay				3				
Peru	12		1	16				
Philippines	17	1	1	31				1
Poland	36		4	6				7
Portugal	11		1					
Qatar			1	1				1
Republic of Moldova				1				
Romania	10		3	22				2
Russian Federation	49		3	89				1
Rwanda								
San Marino								
Saudi Arabia	4	1	3	8				1
Senegal	8			1				
Serbia	7		3	7				2
Seychelles								
Sierra Leone					1			

Table A10. Member State participation in selected Agency activities (cont.)

Member State	No. of research contracts and agreements	No. of Collaborating Centres	Services provided to Member States					
			ALMERA	Dosimetry audits for radiotherapy[a]	Plant irradiation services	QUANUM[b]	QUAADRIL[b]	QUATRO[b]
Singapore	10		1					
Slovakia	8		3	1				2
Slovenia	10		1	1				2
South Africa	33		3	41				5
Spain	28	1	2		2			
Sri Lanka	9		1	7	1	1		1
Sudan	1			2				
Swaziland								
Sweden	14		2					
Switzerland	8		3					
Syrian Arab Republic	8		1	1				
Tajikistan	1			1				
Thailand	27		2			2		2
The former Yugoslav Republic of Macedonia	7		1	19				1
Togo								
Trinidad and Tobago				3				
Tunisia	8		1	9				
Turkey	14		2	36				
Uganda	6			1				
Ukraine	23		1	49				
United Arab Emirates	1		2	2			1	
United Kingdom	55		4		4			
United Republic of Tanzania	7			1				
United States of America	130	1	6		1			
Uruguay	14		1	9				
Uzbekistan	1			12				

Table A10. Member State participation in selected Agency activities (cont.)

Member State	No. of research contracts and agreements	No. of Collaborating Centres	Services provided to Member States					
			ALMERA	Dosimetry audits for radiotherapy[a]	Plant irradiation services	QUANUM[b]	QUAADRIL[b]	QUATRO[b]
Vanuatu								
Venezuela, Bolivarian Republic of	2		2	45				1
Viet Nam	18			17				2
Yemen	1			1				
Zambia	6		1	1				1
Zimbabwe	2			2				

Note: ALMERA — Analytical Laboratories for the Measurement of Environmental Radioactivity; QUANUM — Quality Assurance in Nuclear Medicine; QUAADRIL — Quality Assurance Audit for Diagnostic Radiology Improvement and Learning; QUATRO — Quality Assurance Team for Radiation Oncology.

[a] As of the end of 2015.

[b] From 2005 to 2015.

Table A11. Knowledge Management Assist Visit (KMAV) missions in 2015

Type	Organization/nuclear power plant	Country
KMAV	Nuclear Power Production and Development Company (NPPD)	Iran, Islamic Republic of
KMAV	Smolenskaya nuclear power plant	Russian Federation
KMAV	Ringhals nuclear power plant	Sweden

Table A12. Emergency Preparedness Review (EPREV) missions in 2015

Type	Country
EPREV	Ghana
EPREV	Jamaica
EPREV	Kenya
EPREV	Nigeria
EPREV	United Arab Emirates
EPREV preparatory mission	Hungary

Table A13. Integrated Regulatory Review Service (IRRS) missions in 2015

Type	Country
IRRS	Armenia
IRRS	Croatia
IRRS	Hungary
IRRS	India
IRRS	Indonesia
IRRS	Ireland
IRRS	Malta
IRRS	United Republic of Tanzania
IRRS follow-up	Finland
IRRS follow-up	Slovakia
IRRS follow-up	Switzerland
IRRS follow-up	United Arab Emirates

Table A14. Operational Safety Review Team (OSART) missions in 2015

Type	Location/nuclear power plant	Country
OSART	Bruce B	Canada
OSART	Dampierre	France
OSART	Kashiwazaki-Kariwa Units 6&7	Japan
OSART	Chashma 1	Pakistan
OSART	Novovoronezh Unit 5	Russian Federation
OSART	Sizewell B	United Kingdom
OSART Corporate follow-up	CEZ Corporate	Czech Republic
OSART follow-up	Chooz B	France
OSART follow-up	Clinton	United States of America

Table A15. Integrated Safety Assessment of Research Reactors (INSARR) missions in 2015

Type	Location/research reactor	Country
INSARR	TR-2 research reactor	Turkey
INSARR follow-up	Lena research reactor	Italy
INSARR follow-up	Triga Mark II	Slovenia
Pre-INSARR	RPI	Portugal

Table A16. Safety expert missions for research reactors based on the INSARR methodology in 2015

Type	Country
Safety mission	China, Islamic Republic of Iran, Jamaica, Jordan, Peru, Uzbekistan

Table A17. Safety Aspects of Long Term Operation (SALTO) missions in 2015

Type	Location/nuclear power plant	Country
SALTO	Tihange 1	Belgium
SALTO	Qinshan	China
SALTO	Laguna Verde	Mexico
SALTO	Koeberg	South Africa

Table A18. Safety Assessment Review (SAR) service missions in 2015

Type	Location/design	Country
GRSR	CAP1400	China
GRSR	ACP1000	China
GRSR	ACP100	China
SAAP	Kuala Lumpur	Malaysia

Table A19. Education and Training Review Service (ETReS) missions in 2015

Type	Country
ETReS	Philippines
ETReS	Thailand

Table A20. Site and External Events Design (SEED) missions in 2015

Type	Country
SEED	Bangladesh
SEED	Jordan
SEED	Thailand
SEED	Viet Nam

Table A21. Occupational Radiation Protection Appraisal Service (ORPAS) missions in 2015

Type	Country
ORPAS	Ecuador
ORPAS	United Arab Emirates
Pre-ORPAS	Ecuador
Pre-ORPAS	Ghana

Table A22. Advisory missions in 2015

Type	Country
Regulatory infrastructure for the control of radioactive sources	Bosnia and Herzegovina, Lao People's Democratic Republic, Papua New Guinea, Uruguay
Review of progress of planning for decommissioning of the Bandung research reactor and the implementation of Project INS/9/024	Indonesia
International peer review of mid- and long term roadmaps towards the decommissioning of TEPCO Fukushima Daiichi nuclear power plant	Japan
Advisory mission to assess the current situation at uranium mining legacy sites in Kazakhstan	Kazakhstan
Coordination Group for Uranium Legacy Sites (CGULS) Minkush working group — First review of remediation concept for Minkush site, Kyrgyzstan, held between Rosatom, the EC and the Agency	Kyrgyzstan
Advisory mission to provide technical advice to develop capacity needed in dealing with accidents involving radioactive sources, including remediation and radioactive waste management	Singapore

Table A23. International Physical Protection Advisory Service (IPPAS) missions in 2015

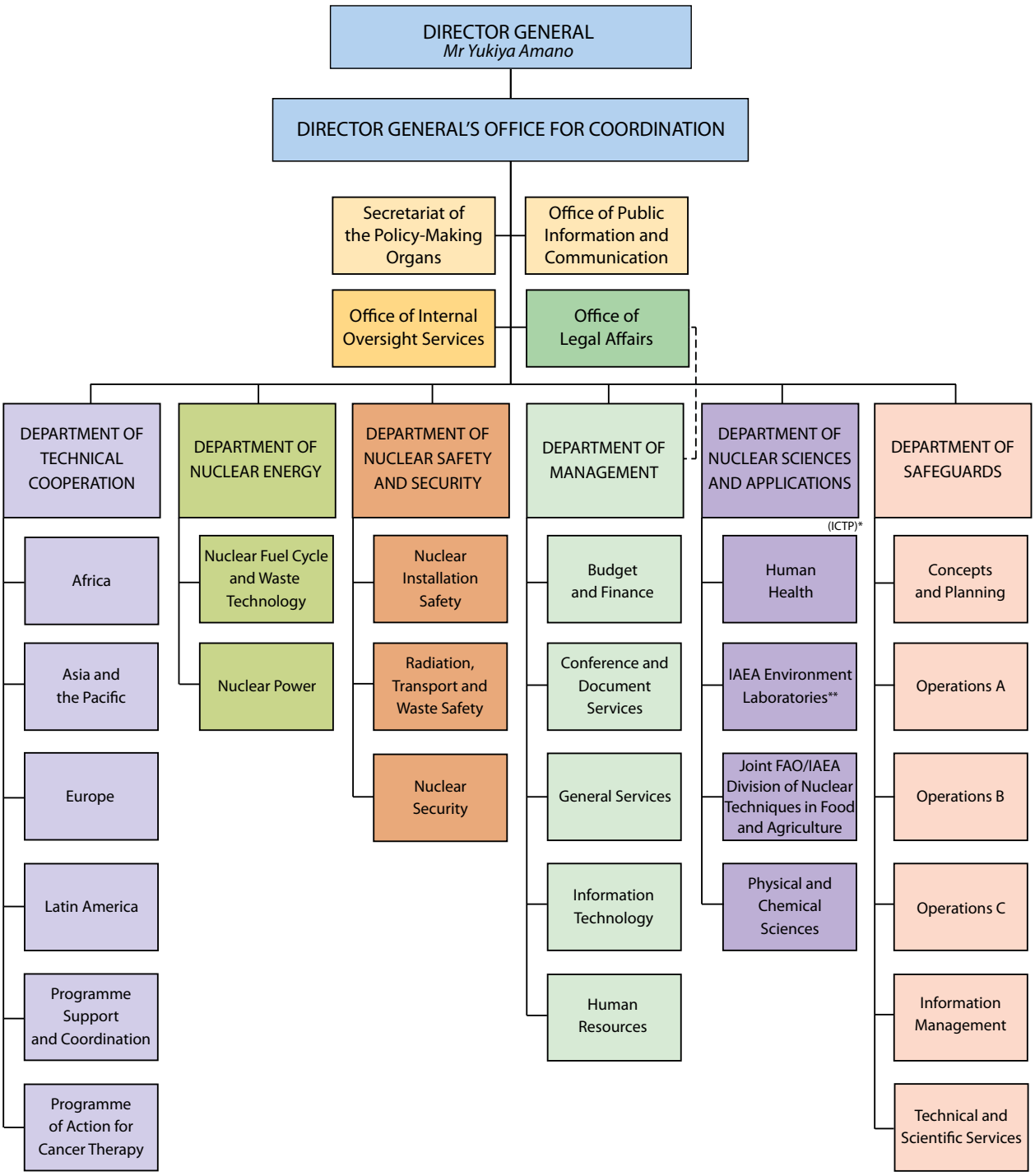
Type	Country
IPPAS	Canada
IPPAS	Japan
IPPAS	New Zealand
IPPAS	Norway

Table A24. Education and Training Appraisal (EduTA) missions in 2015

Type	Country
EduTA	Israel
EduTA	Lithuania
EduTA follow-up	Greece

ORGANIZATIONAL CHART

(as of 31 December 2015)



* The Abdus Salam International Centre for Theoretical Physics (ICTP), legally referred to as the "International Centre for Theoretical Physics", is operated as a joint programme by UNESCO and the Agency. Administration is carried out by UNESCO on behalf of both organizations.

** With the participation of UNEP and IOC.

"The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world."

Article II of the IAEA Statute

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