2020

IAEA

Technical Cooperation Programme

The IAEA Technical Cooperation Programme

Selected Highlights

2020

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SUSTAINABLE DEVELOPMENT GOALS

2020

FOREWORD BY THE DEPUTY DIRECTOR GENERAL

The technical cooperation (TC) programme is the IAEA's major vehicle for delivering support to Member States on the peaceful application of nuclear science and technology. The programme is designed together with Member States to meet national, regional, and interregional development priorities, and contributes to the attainment of the Sustainable Development Goals.

The technical cooperation programme is active in 146 countries and territories, including 35 least developed countries, and provides support in a wide range of areas that address crucial development issues, including health and nutrition, food and agriculture, water and the environment, industrial applications, nuclear knowledge development and management, safety and security, and energy. Regional projects are used to address common challenges across national boundaries including the needs of least developed and small island developing states.

The TC programme supports countries through targeted capacity building which includes short and long term training as well as provision of expert advice, procurement of equipment, and the establishment and strengthening of nuclear and radiation safety and security.

This brochure showcases a selection of 2020 technical cooperation success stories across Africa, Asia and the Pacific, Europe, and Latin America and Caribbean. I hope this will help readers better understand the technical cooperation programme and the ways in which the programme supports the sustainable development of Member States.

HUA LIU,

IAEA Deputy Director General and Head of the Department of Technical Cooperation

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Bosnia and Herzegovina Veterinary Labs Equipped to Diagnose Animal Diseases Using Nuclear-Derived Techniques

A scientist at the Veterinary Faculty of the University of Sarajevo analyzing genome sequences as part of a Joint FAO/IAEA project. (Photo: Veterinary Faculty of the University of Sarajevo)

"Thanks to the milestone we have just reached in performing diagnostic tests quickly and reliably, we have now made a big step forward to fulfilling the standards of the EU."

— Toni Eterovic, research scientist at the Veterinary Faculty of the University of Sarajevo

Bosnia and Herzegovina veterinary authorities are better equipped to protect livestock from several animal diseases spreading in South-eastern Europe, thanks to the support of the IAEA in partnership with the Food and Agriculture Organization of the United Nations (FAO). This is an important step for food security in the country and for the export of animal products and food to the European Union market, local officials have said.

"Early detection of transboundary animal diseases such as Blue Tongue disease (BT), lumpy skin disease (LSD) and Brucellosis is key to prevent their spread and impact on the economy," said Ivancho Naletoski, Animal Health Officer at the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

Brucellosis has been present on the Balkan peninsula over centuries as an endemic disease of livestock, while BT and LSD have emerged recently. They continuously threaten the lives of farmers, producers, exporters and their families. Brucellosis is transmitted among animals through direct and indirect contact, while BT and LSD are transmitted by blood-sucking insects such as mosquitoes, ticks and fleas. All can have a significant effect on animal health and production, as well as on the economic output and international trade of a country.

Traditionally endemic in Africa and Asia, LSD emerged in Turkey in 2013 and has since spread through South-Eastern Europe. The IAEA has been supporting Bulgaria and Serbia to help halt its spread.

Key achievements of the project

- Time needed for pathogen analysis is reduced by a factor of ten, with the support of new equipment and nuclear-derived diagnostic tools.
- The IAEA supported the Public Veterinary Institute Dr Vaso Butozan, in Banja Luka, and the Veterinary Faculty of the University of Sarajevo to build technical and human resource capacity to independently detect, diagnose and intervene against animal diseases using nuclear techniques.

Improving the emergency response capacity of national veterinary laboratories, which are responsible for early detection of these diseases, is essential for Bosnia and Herzegovina to rapidly enforce control measures.

Halting the spread of transboundary animal diseases is a real challenge. In 2012-2014, the IAEA supported the efforts of Bosnia and Herzegovina to improve the diagnostic capacities and control of Brucellosis, a highly contagious disease. The efforts have been partially successful.

“Seven years later, due to the presence of the disease in the country, export of live animals is still not allowed by the EU. However, thanks to the milestone we have just reached in performing diagnostic tests quickly and reliably, we have now made a big step forward to fulfilling the standards of the EU,” said Toni Eterovic, research scientist at the Veterinary Faculty of the University of Sarajevo, who took part in the project.

The IAEA, through its technical cooperation programme and the joint FAO/IAEA Division, provided advanced equipment and training to laboratory staff, enabling them to read entire genome sequences and identify virus strains. “Thanks to the new equipment and nuclear-derived diagnostic tools, we have reduced by a factor of ten the time required for pathogen analysis and have increased the analysis capacity of the lab,” Naletoski said.

“Together with receiving advanced equipment, we needed to learn new methods to expand the scope of our work,” said Violeta Santrac, veterinary researcher at the Public Veterinary Institute Dr Vaso Butozan, in Banja Luka. With IAEA support, staff of the two institutes received advanced training through nine scientific visits to Germany, Serbia and the United States, as well as five fellowships in Austria and Slovenia.

In the past, the two institutes were not equipped to carry out these diagnostic tests independently and required the support of international reference laboratories, which delayed the time of detection, diagnosis and intervention.

The IAEA provided the laboratories with high-tech laboratory equipment and consumables, enabling the in-depth understanding of the epidemiology of BT and LSD using molecular tools such as whole genome sequencing.

The two laboratories will also be equipped with radiological monitoring equipment which will align them with EU regulations for the importation of meat for human consumption.

“Detection of low radiation contamination is critical to prevent long term aggregation of radionuclides in the population, especially in children,” explained Naletoski. Contaminated milk for example, even at a very small dose, can have serious effects on children’s health if it accumulates in the body.

“The newly established capacities will also be important for us to control the food we import,” said Santrac.

IAEA technical cooperation with Bosnia and Herzegovina in 2020

8
Trained

7
Expert assignments provided

50
Meeting participants and other project personnel

South-South/Triangular Cooperation in 2020

Expert and lecturer assignments provided by Bosnia and Herzegovina

Based on data available as of December 2020

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Nuclear Techniques Support Crop Production on Salt-affected Soils in Middle East

"Most Middle East countries are facing severe salinization, and this is projected to increase due to climate change and its consequences: sea level rise and rising air temperature."

— Mohammad Zaman, soil scientist and plant nutritionist at the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture

Key achievements of the project

- Using nuclear and isotopic techniques, farmers from ten countries in the Asia and the Pacific region are successfully growing crops under saline conditions with significant yields.
- Sixty scientists have been trained in a range of nuclear and isotopic techniques, which play a key role in determining the amount of nitrogen and water required by plants.
- Hundreds of Iraqi farmers are reclaiming saline land due to the newly learned farming techniques.

Salinization – the increasing amount of salt content in soil – contributes to land degradation, desertification and subsequently food insecurity. In the Middle East, the main constraint on agricultural development of arid and semi-arid land is limited water availability, making agricultural production difficult. To address the dual challenge of soil salinity and water shortage, the IAEA, in partnership with the Food and Agriculture Organization of the United Nations (FAO), supported ten countries in the region facing severe salinization to improve soil, water and crop management practices with the use of nuclear and isotopic techniques. In 2020, farmers are successfully growing crops under saline conditions with significant yield. Guidelines are now available to help countries produce various crops on different types of salt-affected soils.

Through its technical cooperation programme, and in partnership with the FAO, the IAEA trained and worked with 60 scientists from Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, the United Arab Emirates and Yemen, who are now using nuclear and isotopic techniques to improve crop yields on salt-affected soils. These countries make

A farmer in the upper Mesopotamian plain, Iraq, successfully growing eggplant and forage crops using saline ground water in salt-affected soil. (Photo: I. Abdulrazzaq, Ministry of Science and Technology, Iraq)

up the Cooperative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA).

"Soil salinity is dynamic and spreading globally in over 100 countries, and no continent is completely free from it," said Mohammad Zaman, soil scientist and plant nutritionist at the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture. "However, most Middle East countries are facing severe salinization, and this is projected to increase due to climate change and its consequences: sea level rise and rising air temperature. The major challenges under these conditions are the availability of essential nutrients, especially nitrogen, as well as water for the plants that are adversely affected by excessive salts in the soil."

Let it grow

Since the start of the project in 2014, 60 scientists have been trained in a range of nuclear and isotopic techniques, which play a key role in determining the amount of nitrogen and water required by plants. These included the use of soil moisture neutron probes to monitor soil moisture levels, and the nitrogen-15 isotopic technique which uses stable isotopes to help track how effectively crops are responding to, and taking up, fertilizer. The information generated from

these techniques allows farmers to know the appropriate type and amount of fertilizer and water required based on both the soil properties and the crop types.

With the application of the right kind of irrigation water, the physical and chemical conditions of the soil can be improved over time, as the accumulated salt is washed off, enabling a wider range of crops to germinate and grow. As a result, farmers in participating countries have managed to successfully grow different crops and achieve high production volumes. Examples include millet in Lebanon, barley and safflower in Jordan and quinoa in the United Arab Emirates.

Tomato irrigated with saline groundwater supplied by drip irrigation in the desert areas north of Karbala, Iraq. (Photo: I. Abdulrazzaq, Ministry of Science and Technology, Iraq)

Okra grown under salt-affected land in Syria, with project lead Musadik Janat. (Photo: M. Janat / Atomic Energy Commission of Syria)

Irrigation with saline groundwater

Soil salinization in Iraq is caused primarily by poor irrigation practices such as the use of saline water and soil compaction, leading to low drainage. According to the FAO, it is estimated that Iraq loses about 25 000 hectares per year of agricultural cropping land as a result of salinity.

With support from the IAEA and the FAO, plant biomass produced from growing salt-tolerant crops was used as animal feed. The amount of area under cultivation has increased, as farmers reclaimed saline land – which they now had the techniques to farm. “Hundreds of farmers have now returned to their land from northern to southern Baghdad,” said Ibrahim Bakri Adbulrazzaq, former Director General of the Agricultural Research Directorate of the Ministry of Science and Technology, who led the project in Iraq.

In Syria, scarcity of fresh water, deteriorating water quality and soil salinity are the major limiting factors for agricultural productivity and the sustainability of natural resources. “Results generated through the project were highly valuable,” said Mussadak Janat, researcher at the Atomic Energy Commission of Syria who led the project. “Within three years, the average okra yield became more than 13 tons per hectare, comparable to what can be achieved in non-saline conditions. Barley yield exceeded 5 tons per hectare and about 4.5 tons as dry biomass despite irrigation with saline groundwater, and millet produced more than 3.5 tons grain yield”.

Guidelines to produce crops on salt-affected soils

Based on the experience of experts in the different countries, Guidelines for Salinity Assessment, Mitigation and Adaptation Using Nuclear and Related Techniques have been developed to disseminate knowledge on the sustainable use of saline lands and brackish water, and on salt-tolerant trees and crops in arid lands.

“These guidelines can be used for all types of saline soils, helping farmers in various regions to scale up their production,” said Zaman.

Ecuador

IAEA Member State since 1958

Nuclear Technique Opens New Markets for Ecuador's Fruits

Tree tomato is now exported to markets in the United States, Latin America and the European Union. (Photo: AGROCALIDAD)

Ecuador, one of the largest producers of tropical fruit in the Western Hemisphere, is adding non-traditional fruits to its export portfolio as a result of successfully fighting off the Mediterranean fruit fly with the help of nuclear techniques.

After receiving technical assistance from the IAEA, in partnership with the Food and Agriculture Organization of the United Nations (FAO), to use – along with other methods – the Sterile Insect Technique (SIT) to control the flies, farmers are now shipping golden berries, dragon fruit and tree tomatoes to markets in the United States, Latin America and the European Union.

"The completion of the project will directly contribute to improving the livelihood of fruit producers in Ecuador by reducing the damage caused by fruit flies and increasing production for external markets," said Rodrigo Salas, Head of the Undersecretariat for Nuclear Control and Applications.

Mediterranean fruit fly is one of the most destructive agricultural pests. Its larvae feed on the pulp of host fruits, making the fruit inedible. Due to its ability to easily adapt to different climates and the wide range of fruits and vegetables it infests, many importing countries have quarantine restrictions in place for fruits coming from areas where the fruit fly is well established – in order to protect their own orchards from the pests. Fruits can ripen and rot during the quarantine period, so this measure makes it difficult and costly for producers to reach foreign markets, limiting their export-led growth opportunities.

Ecuador has implemented a fruit fly pest control scheme based on an integrated pest management (IPM) programme including SIT, within the National Fruit Fly Management Project (NFFMP), which was supported by the IAEA and the FAO. The IPM is

Key achievements of the project

- Ecuador implements a fruit fly pest control scheme based on an integrated pest management (IPM) programme including the sterile insect technique (SIT), within the National Fruit Fly Management Project (NFFMP).
- Farmers in the country have begun exporting tropical fruits and vegetables to markets in the United States, Latin America and the European Union.

an effective and environment friendly pest control approach for crop production and protection that combines different management strategies and practices to effectively reduce pest damage, produce healthy crops and minimize the use of pesticides. This approach enables an increase of fruit and vegetable quality and production and facilitates international trade. In Ecuador, SIT was incorporated into the IPM approach in 2018.

"The area under NFFMP, where these non-traditional fruits are grown, covers over 35 000 hectares of commercial fruit production. Its significant reduction of fruit fly damage resulted in increased yields," said Patricio Almeida, Executive Director of Plant Health Control in the Ecuadorian Agency for Regulation and Control of Plant and Animal Health (AGROCALIDAD). "As a result of integrated methods including SIT to suppress the fruit fly population, 2019 exports to the United States of these three fruits reached USD 22 million. In addition, the agricultural sector benefited from direct and indirect jobs that have been created along the production and export chain."

One of the first biological insect control methods developed for areawide application, SIT has been successfully used for more than 60 years and is currently applied in many countries worldwide.

It uses irradiation to sterilize mass-reared male insects so that they cannot produce offspring, which results in reduced pest population over time. "SIT has the added benefit of not introducing invasive insect species into an ecosystem which could upset the fragile biodiversity of a country," said Walther Enkerlin Hoeflich, entomologist at the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

Low flies, high exports

Three million sterilized fruit flies are shipped weekly from El pino fruit fly facility, Guatemala, to continental Ecuador where they are kept at a sterile fly emergence and release facility built under the auspices of an IAEA technical cooperation project. They are then released in fields over targeted production areas where IAEA trained agronomists from AGROCALIDAD monitor and control the fruit fly populations. Thanks to keeping the numbers of fruit flies at acceptable low prevalence levels in growing areas, the USA accepted to import dragon fruit from Ecuador for the first time in 2017. Tree tomatoes and golden berries followed in 2018.

Ecuador is now seeking to expand the use of SIT technology to other areas and other crops: "Currently, 890 farmers benefited from this project," said Almeida. "The promise of future yield and job prospects is an incentive for the country to further invest in the agricultural sector."

Emerged sterile Mediterranean fruit flies ready to be released. (Photo: AGROCALIDAD)

IAEA technical cooperation with Ecuador in 2020

6 Trained

10 Meeting participants and other project personnel

5 Expert assignments provided

Based on data available as of December 2020

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Kenya

IAEA Member State since 1965

Farming on Poor Soil with Little Rainfall in Kenya's Drought-prone Areas: Isotopes Used to Develop New Strategies

Despite poor soil fertility and water scarcity, thousands of farmers in Kenya have increased their crop yields by 17-20% and saved 20% of their fertilizer costs thanks to climate-smart agricultural techniques.

The techniques, introduced with the support of the IAEA, in partnership with the Food and Agriculture Organization of the United Nations (FAO), help improve soil fertility and enable farmers to better manage the crops' water requirements.

Isotopic techniques play a crucial role in assessing nutrient qualities of soil and water resources. A group of scientists from the Kenya Agricultural and Livestock Research Organization (KALRO) used nuclear and isotopic techniques to measure changes in soil's water and nutrients. This effort supports farming practices that keep the soil healthy, improve water and nutrient strategic use, optimize crop yields and increase soil resilience.

Key achievements of the project

- Farmers in Kenya have increased their crop yields by 17-20 per cent and saved 20 per cent of their fertilizer costs thanks to climate-smart agricultural techniques.
- Scientists have installed soil sensors in a number of farmers' fields in several counties to measure soil moisture, temperature and salinity, and advise on irrigation strategies.

These techniques were used in the Kajiado-Central and Tharaka sub counties to assess crop nitrogen use efficiency and to calculate nutrient and water requirements using the stable isotope nitrogen-15 (N-15) and soil moisture sensors. N-15 isotopes, which have the same amount of proton and electron as 'normal' nitrogen atoms, but with an extra neutron, are effective tracers that can be employed to understand the movement of nutrients between soil and plants. They also help to provide quantitative data on the efficiency of nutrients use by crops and this data enables experts to improve water and fertilizer application strategies.

The nitrogen-15 tracing technique is also used to quantify the amount of nitrogen captured from the atmosphere through biological nitrogen fixation by leguminous crops — a natural process in which these crops capture nitrogen from the air and accumulate it in their roots. The nitrogen is released into the soil through the decay of plant roots after harvest, enhancing soil fertility. This technique reduces the need for expensive chemical fertilizers. Intercropping and crop rotations of pearl millet and maize, the main crops in this region, with cowpea, beans, green gram, pigeon peas and other legumes not only saves the expense of nitrogen fertilizers, it also increased average yields by 20 per cent for the cereals and by 17 per cent for the legumes. "This was a win-win for farmers: reducing costs and achieving higher yields," said Joseph Adu-Gyamfi, Integrated Soil Fertility Management Specialist at the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture.

Apart from the nutrients, farmers also need to ensure that the crops receive suitable soil moisture through supplementary irrigation when the rains fail. Scientists have installed soil sensors in selected farmers' fields in several counties to measure real-time soil moisture, temperature and salinity. Once the soil moisture and related data collected is processed, the crop's water requirements can be estimated, and farmers can be advised on irrigation strategies regarding quantity and frequency of watering. The real-time soil moisture measurements data is transmitted to farmers' mobile phones, allowing them to determine when and how much to irrigate.

"KALRO scientists are now helping the farmers to source the seed, which they pay for by themselves," said Isaya Sijali, Irrigation Specialist at the Food Crop Research Institute, KALRO-Kabete. This underscores the sustainability of the project: higher yield provides higher income, which enables farmers to pay for the improved seeds.

The IAEA, through its technical cooperation programme, also supported the upgrade of KALRO's analytical laboratory for agricultural water and nutrient management with the operationalization of an existing Isotope Ratio Mass Spectrometer (IRMS) to meet the capacity for stable isotope analysis for nitrogen-15, the installation and training for a vacuum extraction of water from soil and plant samples for water isotopes analysis and the provision of a laser analyser for stable water isotope analysis of water. "The IAEA's assistance in upgrading equipment has strengthened KALRO's capability to hold national and regional trainings on water management and conduct stable isotope analysis of water and nutrients for neighbouring countries in the future," said Valentina Varbanova, the IAEA Project Management Officer working with Kenya.

IAEA technical cooperation with Kenya in 2020

41 Trained

9 Expert assignments provided

24 Meeting participants and other project personnel

Based on data available as of December 2020

South-South/Triangular Cooperation in 2020

7 Fellows or scientific visitors hosted

18 Training course participants hosted

14 Expert and lecturer assignments provided by Kenya

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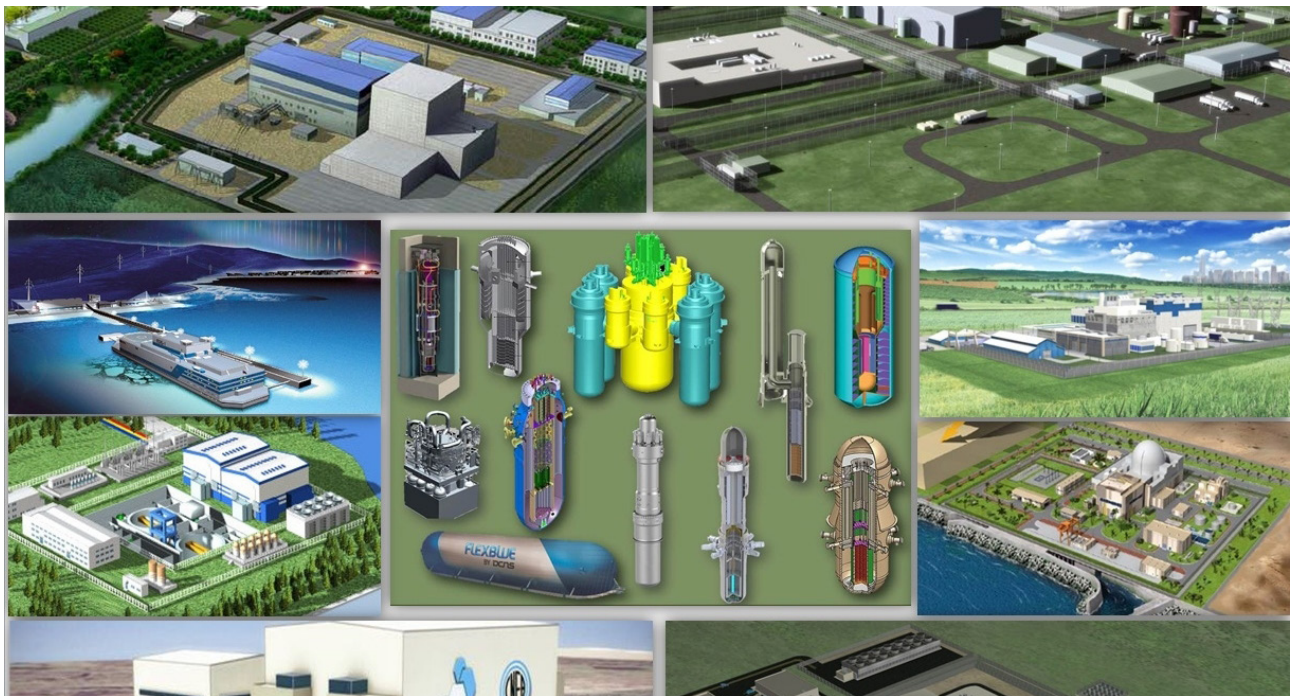
IAEA Launches Project to Help Countries Assess Viability of SMRs for Climate Action



The IAEA recently commenced a two-year regional project, 'assessing the Role of Low Carbon Energy Technologies for Climate Change Mitigation', to assist countries in energy planning as well as determining the role of SMRs in helping them meet their climate targets.

"Flexible and reliable energy sources will need to be a central component of future low carbon energy systems, and SMRs may be ideal for this purpose."

— Frederik Reitsma,
IAEA Team Leader for SMR Technology Development

Climate change is a complex challenge requiring collective action that is urgent and innovative in equal measure. As countries review the options available to them for decarbonizing their energy and industrial sectors, small modular reactors (SMRs) are emerging as an attractive and flexible option for low carbon electricity and heat generation.

In 2020 the IAEA commenced a two-year regional project to assist countries in energy planning as well as determining the role of SMRs in helping them meet their climate targets. The project, part of the IAEA's technical cooperation programme in Europe and Central Asia, involves 25 countries.

While Russia recently deployed an SMR, wider deployment of this technology is expected to begin over the next decade, with around 50 design concepts under development. SMR components will be prefabricated before assembly on site, which is expected to reduce construction times compared to large reactors. With output of no more than 300 MW(e) per unit, SMRs will also require less upfront capital and lower financing costs. Capacity can be scaled by adding units, which may be well suited for non-electric applications such as district heating.

"Low carbon energy systems often include a lot of variable renewable energy sources (VREs) such as wind and solar, and these need to be balanced by dispatchable low carbon sources if the climate targets are to be met," said Frederik Reitsma, IAEA Team Leader for SMR Technology Development. "Flexible and reliable energy sources will need to be a central component of future low carbon energy systems, and SMRs may be ideal for this purpose."

The project includes workshops, panels and training courses on a variety of relevant topics, including potential SMR applications, infrastructure and logistics issues and the impact of renewable capacity on energy security supplies.

Seeking to reduce greenhouse gas emissions by around one third compared with 1990s levels by 2050, Ukraine plans to increase the role of renewables in electricity production while decreasing nuclear power's share, currently at 53 per cent.

"New nuclear capacities based on flexible SMR technologies may be ideal for integration with renewable energy sources," said Oleksandr Pecherytsia, Deputy Director at Ukraine's State Scientific and Technical Centre for Nuclear and Radiation Safety. Project activities on regulatory and licensing issues will help determine the best way to move forward in this area, he added.

Estonia, which currently uses oil to cover 70 per cent of its energy needs, is also looking at SMRs. The European Union member must meet ambitious EU climate targets for 2030, which include boosting the share of renewables to at least 32 per cent of electricity production. EU members must establish an integrated national energy and climate plan (NECP) for the period from 2021 to 2030 and report on the progress every two years.

"Although Estonia is not planning to use SMRs to meet the NECP 2030 targets, we are analysing whether it would be feasible to add SMRs into our energy mix beyond 2035," said Getlyn Denks, Head of the Estonian Ministry of Environment's Department of Climate. "Ensuring that any potential deployment of SMRs is done safely is a high priority for us, and we will need assistance in capacity building and the drafting of legislation as we consider this option for the future."

The Czech Republic currently generates 35 per cent of its electricity from nuclear power and is looking to replace around 2200 MW of non-nuclear energy sources with new nuclear capacity. The government reviewed potential options from SMR vendors and is also working on its own SMR design called the Energy Well. Activities related to the large-scale deployment of SMRs for electricity as well as district heating will be very useful, said Marek Ruscak, Head of the Department of Nuclear Safety and the Energy Well development project at the research organization Centrum vyzkumu Rez (CVR).

"Energy production is a significant emission contributor, and nuclear power is the only stable source of low carbon energy available," Ruscak said. "As SMRs have a more affordable financial profile than large reactors and have a lower risk of deployment delays, there is a significant economic incentive as compared with conventional nuclear reactors."

Project activities focus on training national energy specialists on how to use IAEA tools and other models to evaluate and assess energy technologies. These results can then be used to assist in the development of their energy and climate strategies. Other topics to be addressed include the role of SMRs in hybrid energy systems that integrate nuclear power and renewables and their potential role in future energy markets.

Participating Member States also have the opportunity to develop country-specific case studies for in-depth analyses of energy technologies, such as conducting a socio-economic evaluation of a potential SMR deployment scenario.

"This project is designed to help countries understand and independently apply models that assess energy technologies in their specific national context," said Christoph Henrich, the IAEA Programme Management Officer in charge of the project. "Only then these countries can take knowledgeable decisions on how to shape their future optimal low-carbon energy mix, while considering other important factors, such as environmental constraints or energy security."

IAEA technical cooperation in Europe in 2020

843

Meeting participants and other project personnel

211

Trained

239

Expert and lecturer assignments provided

Based on data available as of December 2020

South-South/Triangular Cooperation in 2020

690

Fellows, scientific visitors and training course participants hosted

469

Expert and lecturer assignments provided by Europe

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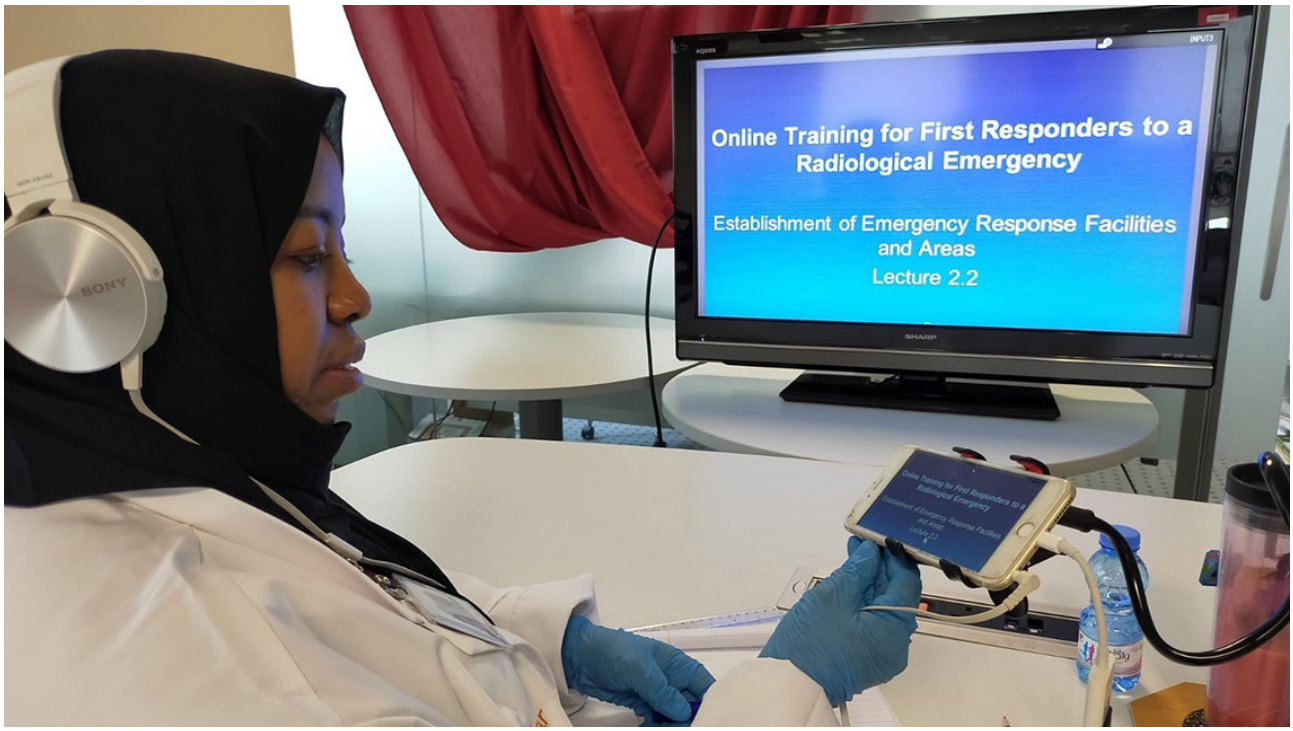
Qatar
IAEA Member State since 1976

IAEA Conducts First Arabic-Language Training Course for First Responders in Radiological Emergencies



Approximately 50 participants took part in a three-day virtual course on emergency preparedness in Qatar. (Photo: Qatari Ministry of Municipality and Environment)

Key achievements of the project

- Fifty participants took part in the IAEA's first-ever emergency preparedness and response (EPR) training course in Arabic.

"Having this course in Arabic has made it more inclusive and of greater practical benefit for the participants."

— Mohammed Al Suwaidi,
Qatar's Ministry of Interior's General Directorate of Civil Defence

In June 2020, the IAEA held its first-ever emergency preparedness and response (EPR) training course in Arabic for personnel in Qatar tasked to be responders in case of a nuclear or radiological emergency. The course was designed to help strengthen and implement Qatar's EPR arrangements.

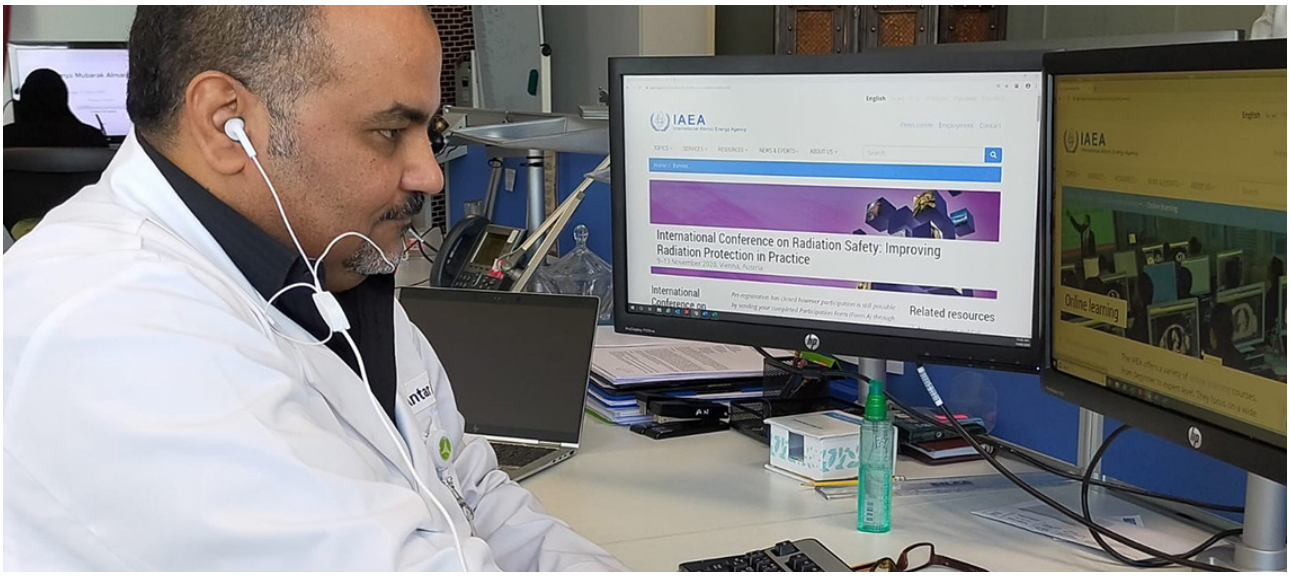
Organized in collaboration with the Qatari Ministry of Municipality and Environment and its Department of Radiation and Chemicals Protection, the virtual course trained some 50 participants. It focused on the responsibilities of first responders, activities associated with the incident and effective communication with the public.

"Having this course in Arabic has made it more inclusive and of greater practical benefit for the participants," said Mohammed Al Suwaidi of the Ministry of Interior's General Directorate of Civil Defence. "We felt comfortable, participated more and asked more questions. Training in Arabic enables us to engage a wider set of stakeholders."

"This course is a first in three ways – it is the first course of this type in Arabic, the first based on new material we have developed for the updated Manual for First Responders to a Radiological Emergency which was published in 2020, and the first offered virtually, to ensure that first responders in Qatar were still trained, even in times of COVID-19," said Muzna Assi, an IAEA Emergency Preparedness Officer.

The training course covered a number of aspects across three modules, including the structure of incident command systems, actions and activities associated with incident commanders from hazards assessments and management of the scene to personnel protection and site decontamination, and best practices for the protection of both first responders and the public.

“From the point of view of customs, the assessment of hazards and personal protection guidelines are particularly relevant to our work, where we may detect radioactivity,” said Khalid Al-Tamimi of the General Customs Authority of Qatar. “This training has allowed us to improve our capacity to respond to nuclear and radiological emergencies.”



While Qatar has no nuclear installations, the proximity of nearby nuclear power plants has highlighted the importance of strengthening Qatari emergency response capabilities and management infrastructures. (Photo: Qatari Ministry of Municipality and Environment)

Qatar has no nuclear installations within its own territory. However, several land-based nuclear power reactors are in operation in the region, and one is in construction as close as 50 kilometres from its borders, necessitating a strengthened nuclear and radiological emergency response capability and management infrastructure.

“We consider this training course to be useful in improving identified arrangements in this area at the national level,” said Bader Al-Saadi, a nuclear engineer at the Qatari Ministry of Municipality and Environment, which is the official regulator for nuclear and radiation activities. “It is also important to us to gain an understanding of what type of assistance can be requested from the IAEA in a radiological emergency, and how to request it.”

In 2010, an IAEA Emergency Preparedness Review (EPREV) follow-up mission assessing national capabilities in the country provided a set of recommendations to Qatar. These outlined the need for an integrated, well-equipped and multi-layered nuclear and radiological emergency preparedness and response programme to cope with new nuclear hazards and their associated radiological risks.

Conserving Life Below Water: Nuclear Techniques to Help Latin America and the Caribbean towards Reaching Sustainable Development Goal 14

Massive accumulation of algal biomass can result in localized deoxygenation of seawater, which may contribute to widescale mortality among less mobile aquatic organisms. This phenomenon can also affect humans either directly by affecting respiration, or indirectly by the consumption of contaminated seafood. This satellite image reveals a large coastal algal bloom. (Photo: ESA)

"We need to increase our capacities to generate qualified information and to establish a solid communication channel to exchange information to ensure our countries effectively contribute to the sustainability of the ocean."

— Ana Carolina Ruiz Fernandez, Researcher, National Autonomous University of Mexico

Latin America and the Caribbean is sometimes called a 'biodiversity superpower' with some of the most beautiful and important endowments of natural capital in the world. But the region is experiencing many anthropogenic and climate-related impacts such as ecosystem degradation, coastal pollution and ocean change. To develop strategies involving tailored nuclear and isotopic techniques to address these challenges, representatives from the region gathered at the IAEA Environment Laboratories in Monaco in early March 2020.

Key achievements of the project

- Twenty-four experts from national authorities of 18 countries agreed on the major environmental threats that need to be addressed and set out a strategic framework for action.

The coastal population is increasing in the region and many who live there depend on the ocean for their income and nutrition, but changes in water temperature and increased ocean acidification and deoxygenation could have a significant impact on local communities. Recent research suggests that current increases in seawater acidity in the region is already impacting the ability of certain marine organisms, such as shellfish and corals, to effectively build their shells and skeletons. This could impact regional fisheries and the livelihoods of those living in the affected coastal zones.

At this first regional coordination meeting of the IAEA Technical Cooperation Project Strengthening Capacities in Marine and Coastal Environments Using Nuclear and Isotopic Techniques, 24 experts from

national authorities of 18 countries agreed on the major environmental threats that need to be addressed and set out a strategic framework for action. Ocean acidification, harmful algal blooms (HABs) and pollution derived mainly from ubiquitous marine plastics were identified as the most pressing environmental concerns that would require coordinated action; sharing key data and enhancing analytical capacities on measuring ocean acidification, eutrophication and marine pollution were also highlighted.

"Existing international policies and treaties calling for responsible use of ocean resources are not enough," said Ana Carolina Ruiz Fernandez, a Researcher at National Autonomous University of Mexico. "We need to increase our capacities to generate qualified information and to establish a solid communication channel to exchange information to ensure our countries effectively contribute to the sustainability of the ocean."

"In the context of climate change, Peru is a very important hot-spot for marine research," said Michelle Ivette Graco, Doctor in Oceanography, Insituto del Mar del Peru (IMARPE). "It serves as a natural laboratory to explore major climate change stressors such as ocean acidification and deoxygenation because of the presence of naturally low acidic Ph levels and oxygen minimum zones in one of the most productive ecosystems in the world."

In this regard, the oxygen minimum zones, in which oxygen saturation in seawater is at its lowest, are a useful key to understanding the oceans' role on atmospheric greenhouse control.

Emily Smail, Executive Director at GEO Blue Planet, noted that this kick-off meeting of the regional technical cooperation project provided valuable insights into the challenges faced by countries in monitoring and achieving targets of SDG 14. GEO Blue Planet is a partnership of more than 100 national governments and over 100 Participating Organizations bridging the gap between data and services to deliver usable information that supports informed decision-making toward reaching sustainable development.

"Partnerships developed at the meeting will allow the GEO Blue Planet initiative to improve our efforts to bridge the gap between the scientific community and decision makers in Latin America and in other regions."

How nuclear techniques can help tackle marine environmental challenges

Nuclear technologies are essential tools to help mitigate and adapt to the effects of sustained climate and ocean change. Nuclear tracers and isotopic techniques can be used to monitor the impacts of ocean acidification and other ocean stressors, and help identify the sources of pollution in the water. Findings can facilitate the scientific community and policy makers to make informed decisions to protect vulnerable ecosystems.

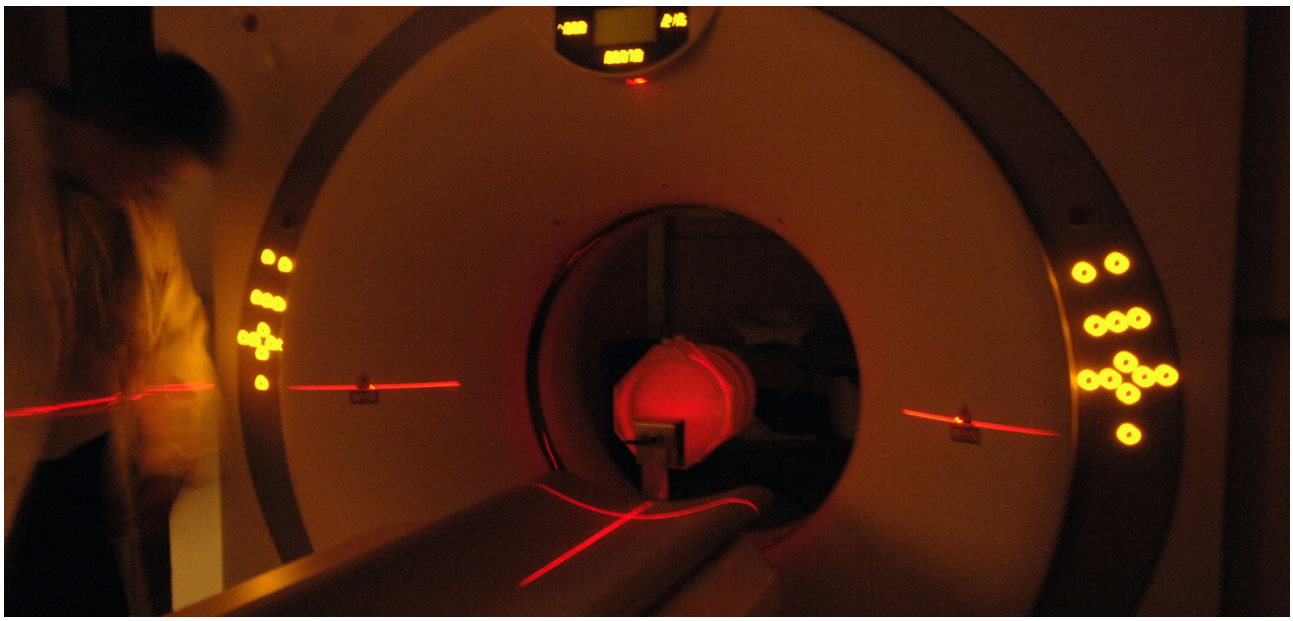
One example discussed was harmful algal blooms, a natural marine process that causes harm to human health and negatively affects ecosystems, and is a threat to coastal zones. Scientists are concerned that climate warming and other anthropogenic activities may exacerbate the intensity and impacts of HABs. For many years, the IAEA Environment Laboratories have promoted the use of a nuclear-based technique known as the Receptor Binding Assay (RBA), a highly sensitive and precise method that allows scientists early detection and monitoring of biotoxins caused by HABs. Several successful applications have been reported and documented in Chile, El Salvador, Colombia and Cuba.

"Early detection of biotoxins is vital in preventing the negative impacts of HABs," said Carlos Alonso Hernandez, Research Scientist at IAEA Radioecology Laboratory. "Nuclear techniques can be used to promptly identify biotoxins in seafood or in the environment, thus help to pinpoint outbreaks with more accuracy. This protects the food chain and can help to limit the amount of time that fishing grounds must be closed."

HABs are just one aspect of this wide-reaching 18-nation project. "The IAEA is dedicated to working with the countries in Latin America and the Caribbean through this technical cooperation project to find practical solutions for their most important marine environmental challenges", said Peter Swarzenski, Acting Director of the IAEA Environment Laboratories.

The project includes experts from Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, the Dominican Republic, Uruguay and Venezuela.

IAEA and African Experts Establish First Harmonized Imaging Quality Control Protocols in the Region



During the Task Force meeting, new quality assurance protocols were elaborated to improve the quality of nuclear medicine services. Here, a head phantom is being aligned in the gantry of a Computed Tomography machine at the Allgemeines Krankenhaus in Vienna, Austria. (Photo: D. Calma/IAEA)

Working with the IAEA, African experts have succeeded in establishing the continent's first harmonized quality control (QC) guidance for nuclear medicine and diagnostic radiology. Following a series of virtual events held as part of an ongoing technical cooperation project[1], the project team has developed protocols with practical guidance on how to perform routine QC measurements to monitor the performance of X-ray and nuclear medicine systems.

The development of more harmonized quality control in Africa was first proposed in March 2020. Aware of the growing use of imaging services using nuclear technology on the continent, and of the corresponding need to ensure their quality and safety, a task force was established to elaborate and draft QC protocols.

Key achievements of the project

- African experts establish the continent's first harmonized quality control (QC) guidelines for nuclear medicine and diagnostic radiology.
- By standardizing data collection and analysis, medical institutions will be able to compare and verify their results across the region.

On 1 June 2020, at the first virtual meeting of the task force, its five constituent members drafted the QC guidance for a variety of imaging modalities, including radiography and computed tomography (CT), among others.

Peer-reviewed by medical physics experts from Africa and Europe, under the coordination of the IAEA Technical Officers, the harmonized QC guidance are enabling hospitals in Africa to closely align their quality assurance programmes by standardizing both data collection and analysis. This will allow medical institutions to compare and verify their results.

1 RAF6053 "Enhancing Capacity Building of Medical Physicists to Improve Safety and Effectiveness of Medical Imaging (AFRA)"

In addition to enhancing effective diagnosis in the African region, the new QC guidance can also be adopted by individual countries that have not yet established their own national quality control programmes.

The harmonized protocols also include nuclear medicine evaluation testing and image-processing parameters, particularly as they relate to in-house IAEA software (NMQC), a plugin used to evaluate the performance and quality of nuclear medicine QC images.

“This important document provides key support to African countries whose capacities for quality assurance were limited in the fields of radiology and nuclear medicine,” said Imen Bentouhami, IAEA Programme Management Officer in charge of the initiative. “This will not only result in enhancing the quality and safety of imaging services in Africa, but will furthermore facilitate a comparison of results, as well as knowledge- and experience-sharing across the region,” Bentouhami continued.

“This document will strengthen the work of the medical physicists, especially in countries where no minimum standards are required by regulatory authorities. A unified harmonized approach will make the learning curve for new colleagues less steep,” said Chris Trauernicht, a medical physicist at the Tygerberg Hospital in Cape Town, South Africa, who served as a member of the task force.

“Quality Control is one of the cornerstones of our work,” said Nadia Khelassi-Toutaoui, another task force member, from the Nuclear Research Centre of Algiers. “The document will serve as a guideline and will facilitate implementation in the region.”

The establishment of effective, harmonized QC methods for high-dose imaging procedures is a key output of the ongoing regional project, which aims to improve the overall safety and effectiveness of nuclear medicine and diagnostic radiology services in Africa through dose optimization and, ultimately, through the development of appropriate quality assurance programmes.

IAEA technical cooperation with Africa in 2020

226
Expert and lecturer assignments provided

573
Trained

589
Meeting participants and other project personnel

South-South/Triangular Cooperation in 2020

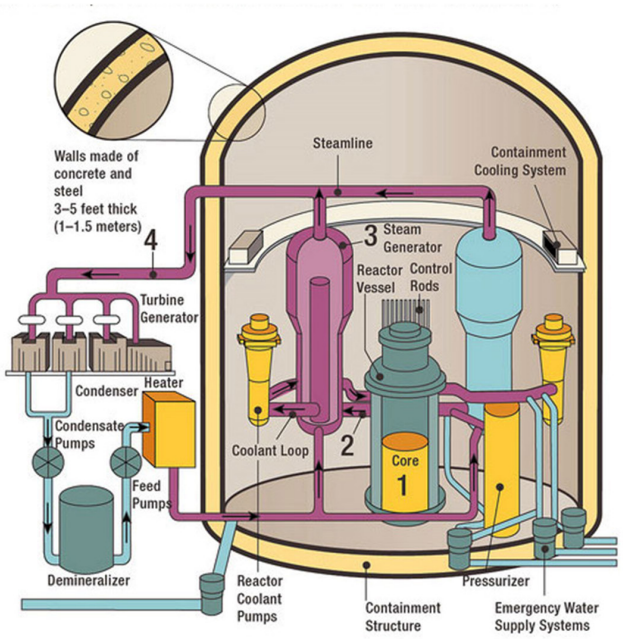
288
Fellows, scientific visitors and training course participants hosted

159
Expert and lecturer assignments provided by Africa

Based on data available as of December 2020

www.iaea.org/technicalcooperation

Assessing and Improving the Safety of Pressurized Water Reactors in Europe, with IAEA Support



PWRs are not only the most common type of light-water reactor, they remain the most common reactor type in use worldwide, accounting for nearly 80% of nuclear power facilities in the Europe region, and approximately 60% globally. (Photo: U.S. Nuclear Regulatory Commission)

"Capacity building in safety is a high priority for the Agency and its Member States, and an essential part of the IAEA technical cooperation support we provide. By developing skills that strengthen safety and by encouraging the exchange of information and knowledge among Member States, the project has helped to ensure the sustainable and safe use of nuclear power."

— Sandra Steyskal, Section Head,
IAEA Technical Cooperation Division for Europe

Throughout the 60-year-long history of the commercial nuclear power sector, light-water reactors (LWRs) have remained a cornerstone technology for the industry, today accounting for most of the nuclear power plants (NPPs) in operation around the world. New, innovative safety solutions have allowed the operation of LWRs to become even safer. An IAEA technical cooperation (TC) project[1], designed to support countries as they adopt and streamline these innovations into their national power programmes, shared specific technical knowledge and precise skills related to the design features and safety aspects of pressurized water reactors (PWRs), a category of LWRs. Core to the support delivered by the IAEA was instruction and training in the formulation of probabilistic safety assessments (PSA).

"Capacity building in safety is a high priority for the Agency and its Member States, and an essential part of the IAEA technical cooperation support we provide. By developing skills that strengthen safety and by encouraging the exchange of information and knowledge among Member States, the project helped to ensure the sustainable

Key achievements of the project

- More than two hundred experts and professionals from 16 countries received training in IAEA Safety Standards and the formulation of probabilistic safety assessments (PSA).

1 RER9144, 'Building Capacity for Infrastructure Development and Safety Assessment of Water Cooled Water Moderated Power Reactor Technology with Advanced Safety Features: the Case of WWER/PWR'

and safe use of nuclear power," said Sandra Steyskal, a Section Head in the IAEA's Technical Cooperation Division for Europe.

Participants included nuclear power plant regulators, operators and technical support staff from 16 countries.

PWRs account for nearly 80 per cent of nuclear power facilities in Europe and Central Asia, and approximately 60 per cent globally. In order to ensure and enhance the safe operation of PWRs across Europe, the IAEA supports countries as they build capacities to develop safety infrastructure and conduct safety assessment of PWRs.

Ana Claudia Raffo, former Director of the IAEA's Technical Cooperation Division for Europe, speaks to training participants at the final regional training course of the project, held in November 2019. (Photo: S. Poghosyan/IAEA)

Sharing expertise

Through workshops, training courses, fellowships and scientific visits, the project developed a more comprehensive understanding of the IAEA Safety Standards in more than 220 experts and professionals participating in the project, particularly as the Standards relate to the operation of PWRs. At all stages of these capacity building events, IAEA experts underlined the Agency's readiness to support the NPP safety- and design-related objectives of Member States, upon request through the IAEA technical safety review (TSR) service on design safety and safety assessment.

Much of the capacity building efforts focused on the implementation of probabilistic safety assessments. By integrating information related to plant design, operating practices, operating history, component reliability, human behaviour, accident phenomena, the PSA methodology facilitates the analysis of a nuclear power plant in its entirety, including its safety systems and installations.

"Thorough knowledge and understanding of safety assessment and design safety is an ultimate prerequisite to achieve a high level of safety throughout the lifetime of nuclear power plants," said Vesselina Ranguelova, Head of the IAEA's Safety Assessment Section. "An independent technical peer review, such as the IAEA TSR, is crucial to assure the quality of the assessments."

Csilla Rudas, an assistant research fellow at the Radiation Protection Department of the Centre for Energy Research in Budapest, Hungary, was one of the counterparts to benefit from trainings organized through the project, and noted that her new skills have already helped advance her ongoing research and work to include Probabilistic Safety Assessment in Hungarian legislation.

More than 220 professionals in the Europe region benefitted from training delivered through the project. (Photo: S. Poghosyan/IAEA)

"The insights and knowledge of the experts was crucial to my research," said Rudas, adding that "the knowledge sharing during the project has helped me, and other participants, to enhance nuclear safety in our respective countries."

A leading specialist on thermal-hydraulic analysis of Nuclear and Radiation Safety Centre of Armenia, Hovhannes Hovhannisyan said, "The knowledge I gained from this project has already helped me to further assist the regulatory authority's review of the Armenian Nuclear Power Plant's safety assessments."

More Newcomers Eye Nuclear Power as UAE, Belarus Set to Start Operating First Nuclear Power Plants

Belarus' first nuclear power plant (pictured) is expected to start operating in the coming months. (Photo: Rosatom)

Key achievements of the project

- The UAE has engaged Korea Electric Power Company to commission four 1400 MW(e) pressurized water reactors, which will supply up to 25 per cent of the country's electricity.
- Approximately 100 participants from 41 Member States and several international organizations attended the annual Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure.
- Twenty-eight countries are considering, have started planning or are well advanced in introducing nuclear power.

"Nuclear power can both drive economic growth and help address climate change."

— Dohee Hahn, Director of the IAEA's Division of Nuclear Power

In 2020, Belarus and the United Arab Emirates (UAE) prepared to operate their first nuclear power plants and two other countries building their first reactors, making it a significant year for so-called newcomer countries looking to add this reliable source of low carbon electricity to their energy mix. In January 2020 in Vienna, the IAEA is helping to show the way forward at its annual Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure.

First organized in 2006, the yearly gathering is the IAEA's main forum for countries to share good practices and lessons learned in establishing the infrastructure required for a safe and successful nuclear power programme. Some 100 participants from 41 Member States and several international organizations are attending this year's edition at the IAEA's headquarters.

"We open this year with new momentum in the Agency's work on nuclear power," said Dohee Hahn, Director of the IAEA's Division of Nuclear Power. "Nuclear power can both drive economic growth and help address climate change."

The key place of nuclear power in the clean energy transition was emphasized at the IAEA's International Conference on Climate Change and the Role of Nuclear Power and by IAEA Director General Rafael Mariano Grossi at the UN Climate Change Summit in December 2019.

In 2020, 28 countries were considering, have started planning or were well advanced in introducing nuclear power. Among its benefits, several newcomers cite nuclear power's low emissions and its steady stream of round-the-clock, or baseload, electricity that can fill output gaps from variable renewables such as solar or wind.

Ghana, which is considering nuclear power, is one such country. "Energy is the blood that runs the development of every country—they all need energy,"

Kwaku Aning, Chairman of the Governing Board of the Ghana Atomic Energy Commission, told the IAEA in a recent interview. “Instead of using fossil (fuels) or any other source, especially for baseload, nuclear is a choice—and a very important choice.”

Belarus and the United Arab Emirates are expected to start operating their first reactors shortly. Belarus’ first plant comprises two 1194 megawatt-electric units of the Russian VVER technology, providing around one third of the country’s electricity needs. The UAE, seeking a reliable low carbon source to meeting increasing energy demand, has engaged Korea Electric Power Company to construct and commission four 1400 MW(e) pressurized water reactors, which will supply up to 25 per cent of the country’s electricity.

Bangladesh and Turkey, meanwhile, have started construction on their first reactors, and Egypt is well advanced in developing the related infrastructure and implementing its programme. Several other countries have taken the decision to add nuclear power to their energy mix and are preparing the necessary infrastructure. The IAEA provides integrated support to all countries in their efforts to establish or expand a safe, secure and sustainable nuclear power programme.

The meeting in 2020 will feature updates on new and expanding nuclear power programmes and discuss the roles and responsibilities of key national organizations, including in developing human resources and implementing management systems. Financing and contracting for new nuclear power plants as well as infrastructure development for small, medium sized or modular reactors (SMRs) are on the agenda.

The meeting will also hear about the IAEA’s comprehensive set of services for countries embarking on, and expanding, nuclear power programmes, including the Integrated Nuclear Infrastructure Review (INIR) and integrated nuclear infrastructure training activities. Four INIR missions are planned for 2020, including one next month in Belarus before its first reactor starts operating.

“Based on the IAEA Milestones Approach, INIR missions help nuclear newcomer countries assess the status of their nuclear infrastructure and identify gaps that require further attention through national action plans,” said Milko Kovachev, Head of the IAEA’s Nuclear Infrastructure Development Section.

Participants will also hear about a major interregional technical cooperation project, held from 2016–2019, through which the IAEA delivered 78 training events for around 1250 participants from 50 countries. France, Japan, the Republic of Korea, Russian Federation and the United States provided financial and in-kind support, while other countries hosted training courses, workshops, seminars and scientific visits. A follow-up project has already started.

“We have been working with the IAEA since the very beginning of the idea of the introduction of nuclear power,” Pawel Pytlarczyk of the Department of Nuclear Energy at Poland’s Ministry of Energy, told the IAEA in a recent interview. Nuclear power “will boost our energy security” and “will limit dramatically the negative impact of the energy sector on the environment by limiting greenhouse gas emissions,” he added.

Improving the Calibration of Radiation Monitoring Instruments in Latin America and the Caribbean

A technician positions the neutron source for the calibration of monitors at the Neutron Laboratory at the Brazilian Institute for Radiation Protection and Dosimetry at the National Nuclear Energy Commission. (Photo: E. Zappia/IRD/CNEN)

"Instruments for detecting nuclear radiations play a key role in modern life, as they are used in various sectors, from industry to medicine and energy production."

— Roberto Bedogni, IAEA expert

Radiation monitoring is essential for an effective radiation protection programme, ensuring that neither the operating personnel nor the public receives radiation doses above permissible limits. "Instruments for detecting nuclear radiations play a key role in modern life, as they are used in various sectors, from industry to medicine and energy production," said IAEA expert Roberto Bedogni. "Calibrating these devices is far more than just applying a procedure; it requires solid scientific basis and cutting-edge equipment."

The IAEA conducted two webinars in 2020 targeting radiation metrologists working at Secondary Standards Dosimetry Laboratories (SSDLs). SSDLs provide traceable calibration of radiation monitoring instruments, such as survey meters and reference irradiations of personal dosimeters. The webinars focused on calibration of radiation protection dosimeters and workplace monitoring instruments, as well as calibration using neutron sources at SSDLs.

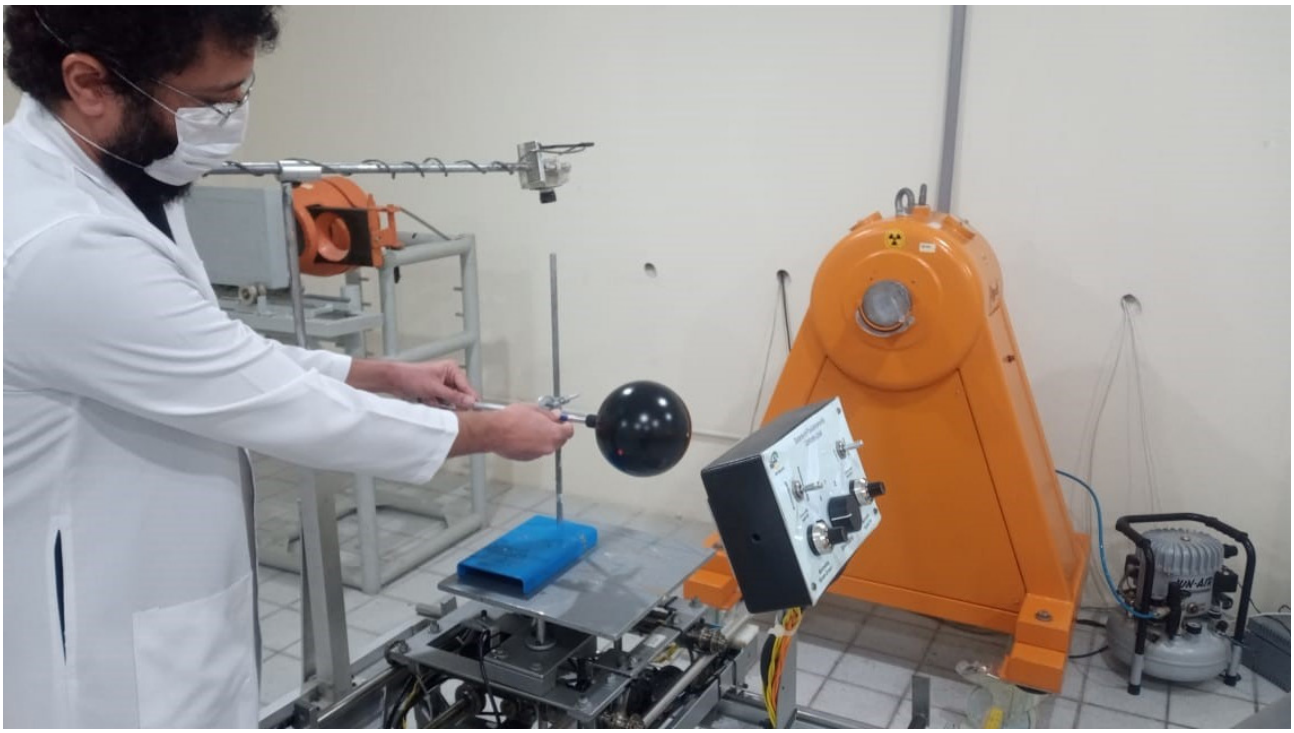
Key achievements of the project

- Seventy-five participants from 17 countries attended the webinars on calibration of radiation protection dosimeters and workplace monitoring instruments, as well as calibration using neutron sources at SSDLs.

Though neutron radiation is frequently encountered in the energy, industrial and medical sectors, not many SSDLs with neutron calibration capabilities have been developed worldwide. Consequently, establishing the technical basis for neutron calibrations at SSDLs is a key to strengthening these sectors.

"The webinar on calibration of radiation protection dosimeters was based on the new ISO 4037 standard of 2019, which deals with reference photon radiation," said Milos Zivanovic, IAEA expert leading the first webinar. "There are many important novelties

presented by this standard, especially regarding the use of X-ray. The laboratories learned about the procedures and related new equipment requirements."



Seventy-five participants from 17 countries attended the webinars, which included interactive elements that allowed the participants to engage in live quizzes and technical discussions with international experts, IAEA staff and peers in the region. The courses are available in Spanish on the website of the Network for the Optimization of Occupational Radiation Protection in Latin America and the Caribbean (REPROLAM).

The webinars were organized in the framework of the IAEA Technical Cooperation project "Strengthening Regional Capabilities of End Users and Technical Support Organizations on Radiation Protection as well as Emergency Preparedness and Response in Line with IAEA Requirements" covering thematic safety area related to occupational radiation protection, radiation safety in the medical practice and radiological emergency preparedness and response.

IAEA technical cooperation in Latin America and the Caribbean in 2020

191 Trained

196 Meeting participants and other project personnel

230 Expert and lecturer assignments provided

South-South/Triangular Cooperation in 2020

56 Fellows, scientific visitors and training course participants hosted

166 Expert and lecturer assignments provided by Ecuador

Based on data available as of December 2020

www.iaea.org/technicalcooperation

Uganda

IAEA Member State since 1967

From Emergency to Expansion: With IAEA Support, Uganda Recovers and Improves its Radiotherapy Services

Ignatius Komakech (left) was an alumni of the TC Fellowship programme and, today, works as a medical physicist in the Uganda Cancer Institute. (Photo: O. Yusuf/IAEA)

In early 2016, the sole functioning radiotherapy machine in Uganda broke down, leaving 40 million people in this East African country without access to this life-saving treatment.

Following a request from the government, the IAEA provided expert services, staff training and procurement of equipment through its technical cooperation programme, leading to the procurement and installation of a new machine and the re-establishment of radiotherapy services in the country.

Agency support continued throughout 2016 and 2017, and a new, national cancer control project—launched in January 2020—now promises to continue the path towards stronger, more accessible cancer therapy services.

Expanding nuclear medicine and radiotherapy services

The Uganda Cancer Institute (UCI), which housed the radiotherapy machine, is a cancer research, healthcare and training institute of the Ugandan Ministry of Health, and it receives more than 5,000 new cancer patients each year. Both diagnostic and treatment facilities are essential to any cancer institute, allowing doctors to assess the site and extent of the cancer accurately, and to plan the most effective treatment. As a consequence of the types of tumours seen most commonly in Uganda, more than half of the individuals diagnosed at the UCI would then benefit from radiotherapy, and breakdown of the service was disastrous. Overall, assessments made by the International Agency for Research on Cancer show

Key achievements of the project

- Procurement of a new radiotherapy machine to re-establish radiotherapy services in Uganda.
- Launch of a new national cancer control programme in January 2020.
- Provision of a dual-head gamma camera to increase the volume of cancer patients' imaging scans.
- Introduction of a brachytherapy service and accompanying human resource capacity building activities.

that there are an estimated 34 000 people developing cancer each year in the country with 23 000 patients tragically dying of related illnesses.

In the quest to reduce the mortality of cancer, improving the accurate staging of the disease is essential. Despite receiving thousands of referrals from health clinics around Uganda to conduct diagnostic evaluations, the nuclear medicine (NM) unit at the Mulago National Hospital—the only such facility in the country—could only provide imaging services to a small fraction of their patients.

Five technical cooperation projects were launched on the request of the Government—beginning in 2012 and continuing through follow-up projects—to provide much-needed equipment, technical support and capacity building. The Agency also supported the procurement of a dual-head gamma camera to replace a former single-head camera, which will radically increase the volume of patients who can be imaged each day. In addition, a medical physicist, a nurse, a technologist and a radiographer were trained through IAEA-supported technical cooperation fellowships as part of two projects designed to support the NM unit.

Following the breakdown of the UCI's radiotherapy machine, strengthening and expanding access to radiotherapy was prioritised by the Government in its national technical cooperation programme.

In addition to supporting the procurement of one new cobalt-60 machine and the commissioning of a second which was donated by the Government of India, the IAEA procured specific equipment to allow the introduction of a brachytherapy service for patients with oesophageal cancer and, additionally, organized nine fellowships to help to develop the human resources essential to operate and maintain the new equipment properly. These comprised four radiotherapy technologists and four medical physicists.

"This Fellowship truly redefined my perceptions and the goals I had, as far as cancer care and management is concerned," said Ignatius Komakech, an alumnus of the TC Fellowship programme. "The Fellowship training provided me with an in-depth understanding of medical physics, its application in a clinical context, as well as the roles and responsibilities associated with resident medical physicists."

Charting the path to better outcomes

In 2016, following a series of IAEA advisory missions, the UCI began construction of a new radiotherapy department, with six new bunkers to house teletherapy and brachytherapy machines, as well as modern linear accelerators. In addition, new support buildings for activities related to cancer treatment, such as operating theatres and nuclear medicine hot labs, are being built.

The large-scale expansion of the UCI, and the corresponding expansion of available services, means that training for more personnel to treat the thousands of patients who will visit the Institute each year is urgently needed.

A national project, launched in January 2020, responds to this need by supporting capacity building for new staff. The project is supporting the introduction of new equipment,—including commissioning of the linear accelerator, CT-Simulator and 3D treatment planning system—as well as the provision of retraining opportunities for existing personnel to allow them to capitalise on the potential of the new technologies.

A series of short-term training courses will facilitate the development of new quality assurance systems and procedures, to ensure that safety underpins all activities at the Institute. To promote greater sustainability and to accommodate the increasing demand for trained professionals in Uganda, the project will also support the development of an academic training programme for radiotherapy technologists, and the development of a clinical training scheme for medical physicists based on a syllabus established through the African Regional Cooperative Agreement on Research, Development and Training related to Nuclear Science and Technology (AFRA).

IAEA technical cooperation with Uganda in 2020

16
Trained

15
Meeting participants and other project personnel

Based on data available as of December 2020

www.iaea.org/technicalcooperation

IAEA Promotes the Integrated Management of Invasive Aedes Species in Europe

Visit of the meeting participants to the Athenian suburb of Vravrona, where an IAEA-supported SIT pilot trial was conducted. (Photo: G. Balatsos/Benaki Phytopathology Institutes)

"In 2019, following the pilot releases, a 90% reduction in the population of Aedes albopictus mosquitoes was observed when compared with the reference site."

— Antonios Michaelakis, Researcher at the Department of Entomology and Agricultural Zoology at the Benaki Phytopathology Institute in Greece

The spread of invasive pests to any new region has implications for national and regional public health authorities. For European health officials, mosquitoes in the Aedes genus are of concern, as they are responsible for the transmission of many pathogens and parasites. Since 2016, an IAEA technical cooperation (TC) project[1], implemented with the support of the Food and Agriculture Organization of the United Nations (FAO), has supported the integration of the sterile insect technique (SIT) into existing national and local pest control strategies, to help delay, curtail and contain the spread of pathogen-carrying mosquitoes in Europe.

Key achievements of the project

- The IAEA and the Food and Agriculture Organization of the United Nations (FAO) are supporting European Member States in the integration of the sterile insect technique (SIT) into existing national and local pest control strategies.
- Following a pilot SIT trial in Greece, a 90 per cent reduction in the population of Aedes albopictus mosquitoes was observed.

During the project's final coordination meeting, held in Athens, Greece in February 2020, FAO/IAEA experts and counterparts revised the work plan for a follow-up TC project[2], launched in 2021, with the support of representatives of the World Health Organization (WHO).

High volumes of international trade and travel, as well as rising global average temperatures in recent years, have helped to provide the conditions for the introduction of at least five species of Aedes mosquitoes into Europe,

1 RER5022, 'Establishing Genetic Control Programmes for Aedes Invasive Mosquitoes'

2 RER5026, 'Enhancing the Capacity to Integrate Sterile Insect Technique in the Effective Management of Invasive Aedes Mosquitoes'

creating new public health risks which will require the attention and efforts of experts from several fields to effectively contain the spread of the mosquito species.

From 24 to 28 February 2020 in Athens, 18 participants from 10 countries met with five experts and three representatives of the WHO to review the lessons learned and best practices developed during the first project, and to prepare the activities of a subsequent, follow-up project. The participants discussed how to integrate and use SIT within the context of an integrated Aedes-control programme and explored the possibility of closer collaboration with their respective European Ministries of Health and with the WHO. During the meeting, participants visited the area where an SIT pilot trial was implemented in Vravrona—east of Athens—and noted the engagement of local stakeholders, from municipal community leaders to representatives from the private insect pest control sector.

Under the auspices of the first project, which ran from 2016 to 2020, a series of capacity-building workshops and training courses were organized to disseminate the skills necessary for the effective integration of the SIT. Moreover, some countries launched pilot SIT trials between 2017 and 2019. In Vravrona, for example, 15 000 male mosquitoes per week were sterilized and released in a five-hectare area in 2018, and an additional 30,000 per week were released in an increased area of ten hectares in 2019.

A female Aedes albopictus mosquito. (Photo: T. Wallner/FAO/IAEA)

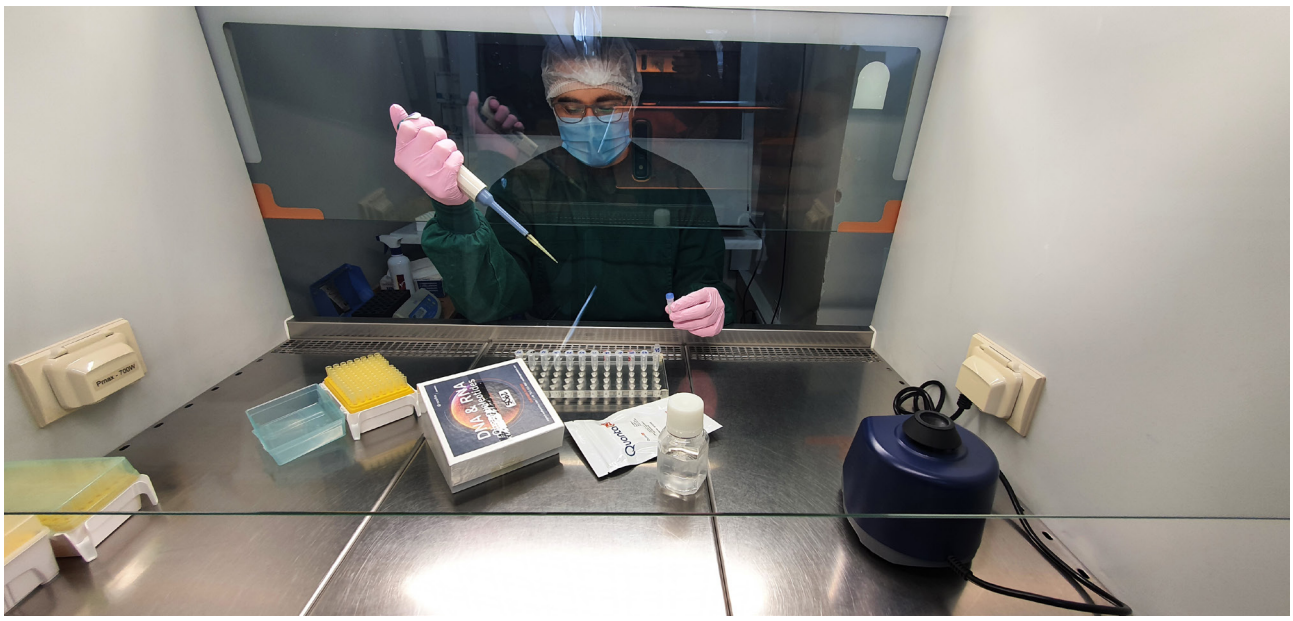
The threat of vector-borne diseases is not altogether new to European health officials, however. Outbreaks of chikungunya took place in Italy in 2007 and 2017, while endemic cases of chikungunya virus infection were detected in Southern France in 2010 and 2017, and local dengue cases were registered in Croatia in 2010 and in France in 2014 and 2018. Local transmission of Zika was also recorded in France in 2019. Additionally, the rising incidence of container-breeding species of Aedes mosquitoes in Europe—including A. japonicus, A. atropalpus and A. aegypti, a vector which carries and spreads dengue, Zika, Mayaro and yellow fever—has drawn international attention to the subject of vector control.

These experiences have reinforced the health hazards associated with the uncontrolled spread of invasive pests in the imagination of the public, and have highlighted the prevention, containment and suppression roles to be played by public health policy-makers and entomologists. Reflecting existing European Union (EU) policies for the reduction of insecticide use, decision-makers in the region are increasingly considering the SIT to provide an environment-friendly alternative for pest control. They also plan to develop detection and early response procedures in the event of new introductions of A. aegypti, to eliminate these outbreaks before they spread, and to further protect the Europe region, where SIT may play an important role.

“In 2019, following the pilot releases, a 90 per cent reduction in the population of Aedes albopictus mosquitoes was observed when compared with the reference site,” said Antonios Michaelakis, Researcher at the Department of Entomology and Agricultural Zoology at the Benaki Phytopathology Institute in Greece. He also said, “This result has demonstrated that the SIT could help suppressing mosquitoes and reducing the use of insecticides which are negatively impacting human health and environment.”

Based on the successful SIT pilot in Greece, the participating countries will continue working towards the integration of SIT as part of their area-wide integrated pest management.

IAEA's Support for COVID-19 Testing Equipment



An IAEA donated COVID-19 diagnostic test kit was delivered to the Reference Laboratory of the Scientific Research Institute of Virology, Uzbekistan in December 2020. The IAEA is dispatching equipment to countries and territories around the world to enable them to use a nuclear-derived technique to rapidly detect the coronavirus that causes COVID-19. (Photo: Reference Laboratory of the Scientific Research Institute of Virology)

Since December 2019, the world has been dealing with a new type of coronavirus, SARS-CoV-2, which causes COVID-19 disease. Declared a pandemic by the World Health Organization (WHO) on 11 March 2020, COVID-19 has affected almost every part of the world, with impacts going far beyond the health sector.

The IAEA has a long and proven track record of developing and deploying nuclear and nuclearrelated techniques for the rapid and accurate detection of animal and zoonotic diseases. Real-time reverse transcription-polymerase chain reaction (RT-PCR) is a key nuclear-derived technique which is used to detect viral pathogens, including the RNA coronavirus SARS-CoV-2 that causes the COVID-19 disease.

Over the past two decades, in partnership with Food and Agriculture Organization of the United Nations (FAO), the IAEA has trained and equipped experts around the world to use real time RT-PCR to detect major zoonotic and animal diseases such as Avian influenza, Ebola and Zika virus diseases, often using its Veterinary Diagnostic Laboratory Network, VETLAB.

In 2020, the Agency was providing support to Member States' efforts to address COVID-19 through the interregional technical cooperation project INT0098, 'Strengthening Capabilities of Member States in Building, Strengthening and Restoring Capacities and Services in Case of Outbreaks, Emergencies and Disasters'.

IAEA support was provided in the form of a package of equipment and materials that included detection equipment (real-time RT-PCR and kits) together with reagents and laboratory consumables, as well as biosafety cabinets and equipment for sampling, testing, quality control and personal protection for the safe analysis of samples.

By the end of 2020, 127 countries and territories had requested IAEA assistance (44 from the Africa region, 27 from Asia and the Pacific, 24 from Europe, and 32 from the Latin America and the Caribbean region), with 285 laboratories/institutions receiving IAEA technical cooperation (TC) support. Several countries had provided 26.3 million in extrabudgetary contributions.

In addition to the provision of equipment, 11 webinars on Standard Operating Procedures (SOPs) were held for health care providers, with over 6000 live participants, and a further 16 RT-PCR webinars were held with just over 2000 live participants. Nine instructional videos were made available on the use of personal protective equipment, collection, transportation and storage of samples, and on real-time RT-PCR for the detection of COVID19. And a further nine videos on the use of serology for evaluation of COVID-19 were also made available on the IAEA's Human Health Campus website.[1]

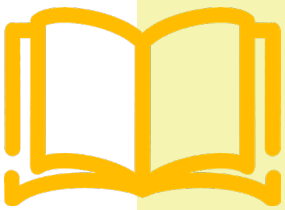
[1] https://humanhealth.iaea.org/HHW/covid19/nmdi/nmdi.html

IAEA COVID-19
assistance figures

127
countries and territories requested and received assistance

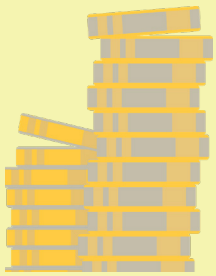
285
national laboratories/institutions received COVID support packages and technical guidance

1950
RT-PCR and diagnostic kits and related items ordered for countries



500+
Animal Production and Health (APH) counterpart laboratories received updated Standard Operating Procedures (SOPs), reagent information and validation data, delivered via VETLAB

Extrabudgetary funding totalling
26.3M



Based on data available as of January 2021

www.iaea.org/technicalcooperation

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Cooperation
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