

International Atomic Energy Agency (IAEA) contribution to the Integration Segment of the Economic and Social Council (ECOSOC) - *Innovative communities: leveraging technology and innovation to build sustainable and resilient societies*

The International Atomic Energy Agency is the world's central intergovernmental forum for scientific and technical co-operation in the nuclear field. It works for the safe, secure and peaceful applications of nuclear science and technology, contributing to international peace and security. The IAEA plays an important role in helping the Member States achieve the Sustainable Development Goals (SDGs) through applications of nuclear science and technology.

Through its technical cooperation programme, the IAEA provides expertise in fields where nuclear techniques offer advantages over other approaches, or where it can effectively supplement conventional means. The IAEA's support enables countries to address critical challenges in the areas of food and agriculture, health and nutrition, water and environment, energy and industry, as well as radiation and nuclear safety.

Furthermore, the IAEA support includes the capacity building efforts in Member States with targeted programmes in the areas of human resources development, knowledge management, knowledge networks and education and training.

Several examples illustrate how nuclear science and technology can be deployed to build sustainable and resilient economies, societies and environments:

- Food and Agriculture

Sudan, Climate-Smart Agriculture Helps Women Farmers to Move Out of Poverty

The IAEA trained scientists from the Sudanese Agricultural Research Corporation on the drip irrigation system that, used in conjunction with isotopic and nuclear-derived techniques to determine moisture levels in local soil, optimizes water and fertilizer applications. The combination of the two, labelled as a model for worldwide use, offers the possibility to start small-scale farms and home gardens in extremely arid areas. Female farmers in the region were trained to use the low-cost drip irrigation system and to properly apply fertilizer; this has improved the livelihood of hundreds of women in Sudan. Through climate-smart agriculture, the women, their families and entire villages now benefit from access to food. Women were empowered, gaining a further share of decision-making in the family and the community. To date, the drip irrigation technology has been adopted by more than 1000 family farmers and been introduced to more than 11 countries.

Animal and zoonotic disease outbreaks: Diagnosis and control

The IAEA has been assisting its Member States to prevent the spread of diseases that can be transmitted from animals to humans, known as zoonotic diseases. Transboundary and zoonotic animal diseases (TADs) kill and impair animals, pose challenges to food production and distribution, threaten public health, and affect rural livelihood.

Nuclear-derived techniques have been proved instrumental for strategic preparedness, rapid diagnosis and early response acting as important tools to address disease outbreaks, and to plan the containment or eradication of such diseases.

Recent epidemics of zoonotic diseases, such as Ebola, avian influenza and Rift Valley fever continue to be threats to public health. Other diseases that kill animals or force massive culling across geographical borders, causing losses of millions of animals and huge economic costs, include the classical African swine fever; peste des petits ruminants; and foot-and-mouth disease, among others. The IAEA supports laboratory networks in improving their screening and diagnostic capacities, and upgrading their equipment and facilities. It also runs proficiency tests of laboratory capacity to diagnose specific diseases and conducts trainings to help the labs achieve accreditation from the International Standards Organization (ISO). One of the most damaging livestock diseases in Africa, the Middle East and Asia is

the highly contagious and widely spread peste des petits ruminants (PPR) virus. It kills thousands of sheep and goats per year. Since 1942, PPR has spread to over 70 countries and 50 others are considered at risk. A global effort is now underway to eradicate PPR by 2030 by using nuclear and other techniques, and the VETLAB network of animal health laboratories will play a crucial role in this effort. Nuclear techniques will be crucial in the eradication efforts through the use of isotope techniques in vaccine development and to monitor the spread of PPR. The laboratories comprising the VETLAB network provides training in the nuclear techniques, as well as support in early and rapid diagnosis and control of PPR.

The IAEA through its technical cooperation programme has also provided diagnostic toolboxes to 35 country laboratories, containing equipment, reagents, consumables, protocols and guidelines for sampling in the field and for early detection of animal and zoonotic diseases under biosecurity conditions.

- Health and Nutrition

Latin American and the Caribbean, Nuclear-derived Techniques to Detect the Outbreak of Zika

The Zika virus was declared by WHO in 2016 an international public health emergency. The early, accurate and fast detection of Zika is key to managing outbreaks and in preventing critical health diseases, as the virus has been associated with several neurological complications in adults as well as birth defects. As part of the IAEA response to emergency events, courses aimed to strengthen the capacity for an early and rapid detection of the Zika virus via the use of nuclear derived technology were organised. The IAEA's support involved the transfer of technology for virus detection based on Reverse Transcription Polymerase Chain Reaction (RT-PCR). This proven and efficient nuclear-derived technique was provided by the IAEA also during the Ebola outbreak in West Africa in 2014.

The emergency assistance included provision of RT-PCR machines, consumables and technical advice, as well as training on how to use the technology to detect the virus and differentiate it from others such as dengue and chikungunya.

Nuclear techniques for early diagnosis of Alzheimer's disease

An estimated 47 million people live with dementia throughout the world of which two thirds live in developing countries. There are many different types of dementia, Alzheimer's disease (AD) being the most common, represent a substantial burden throughout the world and have a considerable medical and socio-economic impact. Dementia is one of the major causes worldwide of disability and dependence among older people. Nuclear diagnostic techniques have developed over the past few decades and since the 1990s, Positron Emission Tomography (PET) scans and brain imaging and brain perfusion single positron emission computed tomography (SPECT) imaging have been instrumental in clinical diagnosis of various brain disorders, including AD and other forms of dementia.

Nuclear techniques can be significant in identifying the underlying disease process several years before symptoms are noticed. Positron Emission Tomography (PET) scans and imaging, with different tracers, offers reliable biomarkers in dementia, which can assist clinicians in diagnosing various dementing disorders, especially in the case of overlapping diseases. The IAEA is engaged in several initiatives to raise awareness on the importance of dementia, including Alzheimer's disease and other neurological diseases. Aspects such as living with a patient with dementia, global burden of neuropsychiatric disorders and the role of nuclear techniques are covered within the scope of the prevention and diagnosis of dementia.

- Water and Environment

Kyrgyzstan and Tajikistan, Nuclear Techniques to Improve Land Use and Soil Conservation

The IAEA provided expert advice and training on the use of fallout radionuclides (FRNs) technique to obtain quantitative estimates of long and short-term soil erosion and deposition in agricultural landscapes. The use of FRNs together with conventional assessment tools has provided a basis for sustainable land use planning and decision making, as well as for the promotion of soil and water

conservation techniques. As a result, annual soil erosion has been reduced from 150 tonnes per hectare to between 8 and 15 tonnes per hectare. Moreover, a considerable amount of nutrients has been retained in farmland for crop production. The project is an integrated transboundary initiative of the Governments of Kyrgyzstan and Tajikistan, addressing the interlinked problems of land degradation and poverty in a critical mountain region, thus promoting sustainable land management practices and contributing to improving the livelihood and economic well-being of the inhabitants.

A similar approach supported by the IAEA has been used to save coffee plantations in Viet Nam, to preserve water resources in Morocco and to protect soil and greening Chile's commercial forests.

- Disaster Recovery

Asia and the Pacific, Help in Recovery from Earthquakes and Floods

Industrial testing using nuclear technology involves the use of radiation, along with other methods, to assess the quality of materials, without causing any damage to them or leaving any radioactive residue. This technique, referred to as non-destructive testing (NDT), uses non-invasive techniques to determine the integrity of material, a structure or component. NDT methods include radiography, a type of radiation technology, and gamma tomography, which is based on the differential absorption in different materials of gamma rays emitted from a radioactive source. These techniques are able to identify structural defects that cannot be discovered through traditional testing methods.

The ability of properly use NDT methods to detect internal unseen structural damage makes it an invaluable tool after a natural disaster. Many important buildings (school, hospitals, offices, historical buildings, etc) survive and it is important to know their integrity before declaring them fit for public use. In addition to the assistance in application of NDT methods, the IAEA has provided medical equipment for hospitals for disaster recovery purposes as many hospitals were also damaged. Furthermore, the IAEA assisted in building regional capacity.

The IAEA, through its technical cooperation programme, assisted Member States in the establishment of national teams that provide services to industries, training centres and certifying bodies that are responsible for the training and certification of personnel involved in non-destructive testing. Most recently the IAEA assistance was requested in the aftermath of the earthquakes in Nepal (2015) and Ecuador (2016).

- Ocean and Climate Change

Marine Environment, Helping Fight Toxic Algal Blooms

The IAEA is developing new analytical methods and conducting environmental research to advance the understanding of the movement and impact on coastal and marine ecosystems of toxic contaminants, such as mercury and lead, persistent organic pollutants (POPs), biotoxins from harmful algae, and naturally-occurring and anthropogenic radionuclides. Many of these contaminants are also known to adversely impact marine organisms that are widely consumed by humans around the globe. Harmful algal blooms can produce natural toxins which may accumulate in fish and shellfish to quantities that are dangerous for human consumption, causing a range of symptoms, from gastrointestinal problems to severe neurological effects and even death.

The IAEA has developed a diverse toolbox that includes radio-labelled tracers, nuclear and isotopic techniques, as well as other analytical methods to precisely track the movement of these contaminants and biotoxins through marine food webs and ecosystems. The IAEA is continuing its assistance to Member States to increase their capacity to rapidly identify such contaminants and their biogeochemical incorporation and transfer up the food chain.

The IAEA contributes to building sustainable and resilient societies through peaceful applications of nuclear science and technology. However, the impact of nuclear technology will be more tangible if integrated into broader development strategies. To this end, the Agency establishes partnerships at

national, regional and international level, to help countries use nuclear science to meet their development targets.