2017/6/19

IAEA 與 NEA 動態報告

2017/6/5- 6/16

IAEA FELLOWS PROTECT THE MARINE ENVIRONMENT

國際原子能總署協助保護海洋環境

Researchers trained at the IAEA Environment Laboratories in Monaco are applying various nuclear techniques back in their home countries to preserve the marine environment. The techniques are helping the former IAEA fellows better protect their oceans and seas — from fighting toxic algal blooms to tracing pollutants in water.

"To foster sustainable development, it is not only important that researchers establish the techniques back in their countries, but that they also transfer the knowledge and expertise they have gained to their colleagues," said Marie-Yasmine Dechraoui Bottein, a research scientist

報告摘要(KEY INFORMATION)

1. 在摩納哥(Monaco)國際原子能總署環境實驗室受過培訓的研究人員正在各自的國家採用各種核子技術來保護海洋環境、追踪水中的污染物。
2. 越來越多國家的科學家正在使用核技術來幫助農民增加農作物產量，並提升化肥的使用效率，使大米、穀物和蔬菜的生長條件達到最佳化。
3. 在亞洲及太平洋從事放射性廢棄物管理工作的專業人員在國際原子能總署培訓課程中獲得了新技能，目的是減少輻射對國人健康和環境的風險。
4. 國際原子能總署舉辦了培訓班，來自 23 個歐洲國家的與會者討論了國際原子能的安全標準，包括輻射防護國際安全標準和輻射源安全。
5. 近期開設的國際原子能培訓課程使來自非洲各地的放射藥理學家獲得了新的技能與知識，並將他們所學到的新知帶回國。
6. 2017 年 5 月 23 日，核能署署長威廉・馬格伍德四世因為在原子能和平用途上的傑出貢獻獲得了 2017 年的榮譽亨利・德沃爾夫・史密斯核政治家獎。
7. 2017 年 5 月 11 日至 12 日，核能署啟動核教育、技術和科技框架，共召集了來自 19 個成員國的 50 名代表參加了研討會，以確保持續安全地利用核技術。

at the IAEA Environment Laboratories. A few months after training the fellows, IAEA experts visit the countries to provide further advice and support them in ensuring the full operation of the laboratories, she added.

Through fellowships, the IAEA's technical cooperation programme strengthens capacities and expands opportunities for professionals working with nuclear science and technology.

Last year, for example, experts from Cuba, Morocco, the Philippines, Singapore, Sri Lanka and Tunisia had the opportunity to participate in specialized fellowships. This article provides an overview of what some of them learned.

Helping fight toxic algal blooms

Biotoxins — toxic substances of biological origin — are a global problem. They come in many forms and can be produced by nearly any type of living organism, from animals to fungi. When toxin-producing algae grow in large quantities, they can affect marine organisms. These phenomena are called harmful algal blooms, or HABs.

If people eat seafood contaminated by biotoxins, they can be poisoned and their lives threatened. It is therefore important to detect biotoxins before the seafood reaches people's plates.

Last year, fellows from affected countries, including Morocco, the Philippines and Tunisia, spent between one and six months at the IAEA laboratories, learning how to detect biotoxins in seafood to better manage HABs.

"Our laboratory will be the first in Morocco to use the technique I learned during my training in Monaco," said Jaouad Naouli, who works at the Water and Climate Division of Morocco's National Centre for Nuclear Energy, Sciences and Technology (CNESTEN).

Naouli's training included learning to apply the receptor binding assay (RBA) technique for biotoxin analysis. RBA focuses on the properties of biotoxins and on the interactions between biotoxins and the receptors they bind with. By using radiolabelled biotoxins, this method allows scientists to determine the quantity of toxins that are present in seafood or in seawater.

"With this highly specific, sensitive and rapid technique, we will have a stronger biotoxin monitoring programme in Morocco," Naouli added.

STABLE NITROGEN ISOTOPE HELPS SCIENTISTS OPTIMIZE WATER, FERTILIZER USE

穩定的氮同位素幫助科學家強化水資源與肥料應用

Naypidaw, Myanmar and Gabarone, Botswana – Experts in a growing number of countries are using a nuclear technique to help farmers increase crop yields, optimize fertilizer use and evaluate varieties of rice, cereals and vegetables for their efficiency in making the best use of fertilizers and adapt agriculture practices to changing climate conditions.

Research has shown that less than 40% of the fertilizer applied globally is taken up by crops, while the remaining 60% is either lost to the atmosphere or to groundwater, or is left in the soil in a form that cannot be taken up by the crop.

"We have cut fertilizer use by around a quarter on the half-acre plot where I tried the new rice variety," said farmer U Kyaw Lay, from the central village of Thar Yar Su, Myanmar. "This represents an important saving for me and my family." In the next growing season, Lay said, he will devote more of his land to this particular rice variety, which he said was also tastier than the kind traditionally used.

Lay and 20 fellow farmers, who agreed to participate in testing best practices using the varieties, received seeds from the country's Department of Agricultural Research, which experimented with 106 existing varieties of rice and identified six that use nitrogen-based fertilizers most efficiently. This means that less fertilizer is needed for their growth, said Su Su Win, Director of the Soil Science, Water Utilization and Agricultural Engineering Division. Researchers have recommended varieties for use in Myanmar's various regions, including marginal lands, typically owned by poorer farmers, as well as in areas where changing climate conditions have led to a reduction in yields of traditional varieties.

Nitrogen plays an important role in plant growth and photosynthesis, the process through which plants convert energy from sunlight into chemical energy. Nitrogen is often added to soil in the form of fertilizer. Using fertilizers labelled with nitrogen-15 (15N) stable isotopes — an atom with an extra neutron compared with 'normal' nitrogen — scientists can track the isotopes and determine how effectively the crops are taking up the fertilizer. The technique also helps determine the optimal amount of fertilizer to use: after the crop has reached saturation with nitrogen, the remaining nitrogen remains in the soil and is prone to leaching.

Finding nutrient-efficient and high-yielding rice

Su Win and her team used the nitrogen-15 isotopic technique, with support from the IAEA and the Food and Agriculture Organization of the United Nations (FAO), to determine the nitrogen uptake of different kinds of rice.

"Rice is the most important crop in Myanmar and important for both food security and

industrial development," Su Win said. Many of the varieties traditionally used in the country are so-called fertilizer-responsive high-yielding varieties — crops that have a high yield only when supported by fertilizers — but farmers often cannot afford fertilizers, so the yield and farmers' earnings remain poor. With the help of the nutrient-efficient new varieties now identified, farmers will have access to crops that have a higher yield without excessive fertilizer use, she said.

Initial results have shown that the judicious application of nitrogen to rice crops led to fertilizer savings of around 30% and reduced the amount of fertilizer lost to the environment by 20%, while also optimizing yield, said Joseph Adu-Gyamfi, a soil fertility specialist at the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

The IAEA and the FAO support the use of this technique around the world, providing assistance through the IAEA technical cooperation programme and acting as a platform for research collaboration through numerous coordinated research projects. Currently, experts from over 100 countries are benefiting from this assistance.

Farmers in Botswana benefit from nitrogen-15 technique

In Botswana, soil scientists are in the earlier stages of using the technique to determine the amount of fertilizer required for green pepper, spinach and other horticultural crops and soils.

"Soil types are different all over the world, so we cannot just use results obtained elsewhere," said Kelebonye Bareeleng of the National Soil Laboratory. "We need to find the right amount of nitrogen needed by our particular crops."

The experiments are still ongoing but, from the initial results, Bareeleng estimates that between one quarter and one half of the fertilizer used on cereal fields could be wasted. Not only does this represent an unnecessary additional expense for farmers, but the unused nitrates could also spoil groundwater near agricultural areas. "For a country like Botswana that relies on underground reservoirs for its drinking water, this is too risky," she said.

In the fledgling horticulture sector, where producers are trying to compete with imports from South Africa, fertilizer represents the highest input cost, so cutting its use significantly has the potential to make the industry much more competitive, Bareeleng said. "This may be the key to the development of this sector in Botswana," she said.

Cabbage in Viet Nam

In Viet Nam, results obtained using the nitrogen-15 technique showed that as much as half of the fertilizer applied to cabbage fields was lost to the environment, creating water pollution and food safety problems, Adu-Gyamfi said. "As a result of a technical cooperation project with the IAEA, local officials are now taking action and advising farmers on the most efficient use of fertilizers."

IAEA HELPS ENHANCE MANAGEMENT OF DISUSED HIGH ACTIVITY RADIOACTIVE SOURCES IN ASIA AND THE PACIFIC

國際原子能總署幫助亞洲和太平洋地區加強管理高度活性的射源

Professionals working in radioactive waste management in Asia and the Pacific acquired new skills at an IAEA training course, aimed at boosting their efforts to reduce risks to human health and the environment in their countries.

During the training course, held last week in Taiyuan City, China, 33 professionals from 18 Member States discussed practical experiences in implementing national strategies such as source repatriation, reuse, recycling and conditioning for safe disposal. Leading international experts in this field presented technical options for the safe management of disused sealed radioactive sources (DSRS).

Radioactive sources are used in a variety of devices in the medical, industrial and agricultural sectors. When they are no longer usable, they have to be removed and stored. Therefore, all countries using nuclear technologies have to make sure they have the ability to properly manage them.

"This training is extremely important for my country. We are planning to implement some of the presented solutions when we go back," said Nanthavan Ya-anant from the Thailand Institute of Nuclear Technology.

Than Ho Quang from the Institute for Nuclear Science and Technology in Viet Nam added: "We are now ready to propose the most adequate strategy for the management of disused, high activity sources in Viet Nam."

The hands-on training included a unique opportunity to practice using a Mobile Hot Cell (MHC), an effective technology for management of DSRS. The MHC is a specially designed chamber for removing radioactive sources from various devices and placing them into capsules for storage, transportation or final disposal. Due to high radioactivity, sources have to be taken out of their casings remotely, from the outside of the hot cell, using special manipulators.

Participants also discussed the Category 1 and 2 inventories in their countries and their plans to deal with these legacy sources. They also identified the needs of countries dealing with high activity sources, as well as developing recommendations for a subsequent action plan.

The five-day training course, organized in cooperation with the China Institute for Radiation Protection (CIRP), was a major milestone in the IAEA's project for enhancing

the radioactive waste management infrastructure in the Asia-Pacific Region.

Building Capacities in Member States

A regional IAEA technical cooperation project, focusing on Radioactive Waste Management Infrastructure in the Asia-Pacific Region, is aimed at enhancing its Member States' capabilities in sustainable, safe and secure management of disused radioactive sources.

Since 2016, a wide range of technology transfer activities has been implemented to enhance capacities of Member States to establish and implement policy and strategy, upgrade radioactive waste management system and procedures, enhance regulatory frameworks, and to carry out safety assessment of storage and disposal facilities.

The project also fosters cooperation and is paving the way to build a community of good practice among the countries of Asia-Pacific Region and beyond.

Background

The MHC is a shielded chamber, which was initially manufactured by NECSA in 2007, based on an IAEA design. The original design of the chamber was the first of its kind in the world; two iterative models have since then been developed, including the Chinese MHC used during this regional training.

The purpose of the MHC is to facilitate direct recovery, handling, and conditioning of high-activity sources (Categories 1 and 2) in safe and secure conditions to facilitate storage or final disposal of DSRS. The MHC can be transported to any location in the world to undertake radioactive source conditioning campaigns. This makes the device particularly suitable for use by countries with smaller nuclear technology applications, as most of these countries lack the necessary, yet highly expensive and specialized facilities to process radioactive sources.

The Mobile Hot Cell technology has already been used to condition disused high activity sources in Brazil, Costa Rica, the Philippines, South Africa, Sudan, Tanzania and Uruguay.

IAEA COURSE HELPS RADIATION PROTECTION OFFICERS CREATE NATIONAL TRAINING PROGRAMMES

國際原子能總署課程幫助輻射防護官員建立國家培訓計劃

Radiation protection officers are specialists who ensure that work involving ionising radiation in medical or industrial facilities is carried out safely in line with national regulations. To help expand this key group of professionals, the IAEA held a train-the-trainers course in which radiation protection officers learned what they need to establish national training programmes.

The 8-12 May course, held in Athens, Greece, formed part of the IAEA's ten-year strategy for education and training in radiation and waste safety.

"Through the course, we provide the future trainers with the technical knowledge, practical skills and teaching capability needed to establish training programmes for radiation protection officers in their countries," said Amparo Cristobal, Radiation Safety Specialist at the IAEA, the lead of the training.

The participants from 23 European countries discussed IAEA safety standards, including the International Safety Standards for Radiation Protection and the Safety of Radiation Sources. They also studied the role, duties and training needs of radiation protection officers, and available related IAEA training material.

In addition, the course included sessions on learning theories and methodologies to design training courses, as well as communication topics such as handling complex questions and using body language.

"The IAEA training boosted my public speaking and presentation confidence. It helped me find ways to make the training I deliver to national and international trainees more interesting and interactive," said one of the participating radiation protection officers, Toms Kusiņš of Latvia.

Train the trainers approach

The train-the-trainers approach aims to create a pool of instructors for radiation protection officers, who are designated by licensee or employer, based on the regulatory bodies' criteria.

The course was part of IAEA Technical Cooperation project RER9142, which aims to establish sustainable education and training infrastructures for building competence in radiation safety.

AFRICAN RADIOPHARMACISTS PUT NEW SKILLS TO USE

非洲放射性藥物學家使用新技術運用在藥物

Radiopharmaceuticals are a key component of nuclear medicine, and are crucial to fighting cancer and several other medical conditions. Their use, however, requires extensive personnel training on patient safety and equipment handling. Thanks to a recent IAEA training course, radiopharmacists from across Africa have acquired new skills and knowledge in this area and have since shared what they learned with their co-workers back home.

“I now feel more confident and more equipped to help my organization develop the in-house production of radiopharmaceuticals,” said Aiboud Abdelmjid, a radiopharmacist at the National Centre for Nuclear Energy and Technology in Morocco, who attended the IAEA’s first comprehensive radiopharmacy training for young professionals from across Africa. “I am able to plan a more effective strategy for the production of radiopharmaceuticals in accordance with the latest development and standards in the industry.”

The training course also covered both the theoretical and practical aspects of radiopharmacy, with lectures on basic science and demonstrations of the most commonly used diagnostic nuclear imaging techniques, single-photon emission computed tomography (SPECT) and positron emission tomography (PET).

“Although all subjects and areas of the course were informative, I was particularly interested about quality management systems governing the safe production and application of radiopharmaceuticals,” said Grace Njiru from the Kenyatta National Hospital in Nairobi, Kenya. “I have been applying most of what I learned from the course at work, and I will be sharing this information with colleagues in various setups including continuous medical education, conferences and symposia.”

The IAEA-sponsored training course took place from January to March at Goce Delcev University in Stip and the University Institute for Positron Emission Tomography in Skopje of the Former Yugoslav Republic of Macedonia. In addition to the experienced staff at Goce Delcev University and IAEA experts, the instructors and lecturers included radiopharmacy professors and practitioners from universities and laboratories across Europe.

“To ensure accurate diagnosis, optimal treatment and patient safety, radiopharmaceuticals need to be of required quality,” said Emilija Janevik, professor of

medical sciences at Goce Delcev University and the main coordinator of the training programme. “To avoid errors in final specifications of the radiopharmaceutical produced, the radiopharmacist must undergo a systematic and comprehensive training.”

At the end of the course, participants were assessed and received certifications. In addition, the IAEA has asked participants to conduct gap analyses of the radiopharmacy practices in their own countries, indicating any additional hardware and training requirements they will need to ensure better practices. This data will help formulate the next phase of the IAEA’s programme support aiming to strengthen radiopharmacy in Africa.

NEA MONTHLY NEWS BULLETIN - JUNE 2017

核能署每月新聞稿 - 2017 年 6 月

NEA DIRECTOR-GENERAL RECEIVES HENRY DEWOLF SMYTH NUCLEAR STATESMAN AWARD

核能署署長獲得核能政治家獎

On 23 May 2017, NEA Director-General William D. Magwood, IV, was honoured with the 2017 Henry DeWolf Smyth Nuclear Statesman Award for his outstanding service in developing and guiding the use of nuclear energy and nuclear materials to benefit society. Jointly established in 1972 by the American Nuclear Society (ANS) and the Nuclear Energy Institute (NEI), the Smyth Award is bestowed upon individuals who have made significant contributions towards the peaceful uses of nuclear energy.

INTERNATIONAL WORKSHOP LAUNCHES THE NEA NUCLEAR EDUCATION, SKILLS AND TECHNOLOGY (NEST) FRAMEWORK

核能署國際研討會啟動核教育、技術和科技框架

On 11-12 May 2017, the NEA organised the launch of the NEA Nuclear Education, Skills and Technology (NEST) Framework with a workshop that brought together 50 representatives from 19 member countries. Nuclear skills and education is an increasingly important challenge for NEA member countries, all of whom need to have a new generation of highly-qualified scientists and engineers to ensure the continued safe and efficient use of nuclear technologies for a wide range of industrial, scientific and medical purposes. The NEA has developed the NEST Framework in partnership with its member countries in order to help address gaps in nuclear skills capacity building and knowledge transfer through multinational collaboration. Participants at the workshop discussed national education and training needs, priorities and practices. The workshop concluded with a common understanding on and a shared interest in the NEST Framework. Formal decisions by member countries on the practicalities associated with the framework will follow in the coming months.