國際組織動態報告
2018/07/23 - 08/10

報告摘要(KEY INFORMATION)

1. 有關穿越邊境之車輛或容器所帶有之輻射物質，可藉由光譜世手持式裝置，正確鑑定種類及其位置，以進而降低非法運送可能性並同時避免突增合法貿易之時間。為確保前線員工能正確且易於操作其偵檢裝置，以符上開效果，其檢測及評估方式便成為國際原子能總署於六月舉辦之研討會關注焦點。
2. 過去 2 世紀密集燃燒石化燃料及砍伐森林約增加 50%之大氣二氧化碳;全球海洋約吸收三分之一之人類所產二氧化碳。因此每年海洋酸化研究之數量均有成長，為使相關國家能適度回應此議題，故產生綜合及比較之需求。國際原子能總署海洋酸化國際協同中心比較並將衡量海洋酸化之方法標準化。此外，該單位亦提供實踐指南並推廣資料存取及在研究社群中分享。
3. 核能技術促使科學家們更正確了解古老地下水之年齡及流向，用以證明長期水資源管理之重要性。為了評估古老地下水之年齡，科學家找出自然發生之放射性同位素濃度，其濃度衰變非常慢且不受在水中及其附近岩石之化學反應所干擾。藉由分析特定同位素，像是溶解於地下水中之氪-81 或氦-4，科學家能計算含水層何時能補充、流動速度多快以及多久更新一次。
4. 用以協助國家建立強大輻射安全架構之新版安全守則現已可提供，支持國家領導階層建立法律及監管架構，以保護工作人員、病人以及對抗輻射暴露之公眾場所及環境。此守則規定 67 項行動項目，以建立並執行輻射安全架構，包含輻射法律架構之建立且就放射性廢棄物管理及除役創立系統。
5. 稻田於收割後，可再次生長，但第二次收割所獲得之產量傳統上僅佔第一次收割產量一小部分。中國農夫現在受益於 FAO/IAEA 之實驗室及場域研究，採用核子技術決定最佳稻米品種及最佳施肥方法以增加第二次收穫產量，使採取正確再生栽培方法之農夫可使其產量達到兩倍以上，並降低對環境之影響。
6. 輪廓繪製係被放射腫瘤科醫生使用之關鍵技術。該程序使用特別設計之電腦軟體以產生病人身體之 3D 影像。這些影像首先鑑定惡性腫瘤之位置及大小，其次畫出健康器官輪廓。一旦上開步驟完成後，腫瘤科醫生基於腫瘤大小及深度好好規劃輻射應抵達之處以及所需使用量，因此國際原子能總署啟動新的二年期偕同研究以衡量講師主導式虛擬學習，對於達成放射治療繪製輪廓的一致性之影響性。
7. 匈牙利有關 Paks 電廠相關人員為進行高層討論，於 2018 年 6 月 26 日拜訪核能署。匈牙利代表團與核能署署長與資深人員會面，提供 Paks 核能電廠計畫更新資料。會議中也處理到電力系統成本及其脫炭作用。

國際原子能總署近日新聞

WORKSHOP AIDS NUCLEAR SECURITY EXPERTS IN TESTING AND EVALUATING TECHNOLOGY USED FOR BORDER MONITORING

舉辦研討會以協助核安專家採用檢測及評估技術以應付邊境監測

Participants characterizing detector performance to various radiation sources. (Photo: C. Friedly/IAEA)

The testing and evaluation of handheld devices that determine what type of radiation is present, for example in vehicles or containers that are crossing borders, was the focus of a workshop held in June at the IAEA's laboratories in Seibersdorf.

The devices, known as spectrometric handhelds, can identify the exact type of radioactive material and its location. Such tools are used for example to quickly locate material that set off radiation alarms at custom control stations.

"We use spectroscopic handheld detectors to monitor radioactive material at the harbour, and it is important that we do not delay the shipment. We must detect within a short time and distinguish between harmless or innocent goods and suspicious materials," said Jeong-Wan Kwon, Head of the Radiological Emergency Preparedness of Response Department with the Korea Institute of Nuclear Safety in the Republic of Korea.

Many border stations have radiation portal monitors installed to detect illicit trafficking. These monitors sometimes raise alarm also for harmless quantities of naturally occurring radioactive material, which is present in goods such as ceramic tiles and fertilizers. Using spectrometric handhelds, the cause of the alarm can be quickly determined, enabling customs officers to prevent the accidental transport or the deliberate smuggling of radioactive material while avoiding delays to legitimate trade.

The 35 participants from 18 States shared experiences, knowledge and expertise on topics such as ensuring that the detectors used by frontline staff are working correctly and are easy to use.

Iain Darby, Head of the IAEA Nuclear Science and Instrumentation Laboratory, said: "Our challenge is to support the inspectors at places such as border crossings to prevent accidental transport or deliberate smuggling of more dangerous radioactive materials amongst the traffic of harmless commercial commodities such as ceramics, without causing huge economic disruption."

Other workshop topics included test planning and setup, instrument familiarization and calibration, and test execution, analysis and reporting. It also focused on modelling and simulation.

Participants tested how well different devices detect different radioactive sources at different distances.

The 25-29 June 2018 workshop also supported the efforts of the Border Monitoring Working Group – a cooperation and coordination mechanism between the European Union, the United States and the IAEA – to detect illicit trafficking of nuclear and other radioactive material that is out of regulatory control.

(原文鏈結)

ADVANCING OCEAN ACIDIFICATION SCIENCE: IAEA OCEAN ACIDIFICATION INTERNATIONAL COORDINATION CENTRE TURNS FIVE

發展海洋酸化科學:國際原子能總署海洋酸化國際協同中心成立達五年

The potential impacts of ocean acidification on marine organisms and livelihoods are an emerging concern for many countries, and the focus of UN Sustainable Development Goal 14.3. (Photo: Jean-Louis Teyssié/IAEA)

As ocean acidification research evolves and more scientific papers are published each year, there is a mounting need to synthesize and compare data so that countries can properly respond to the issue. The IAEA Ocean Acidification International Coordination Centre, or OA-ICC, has been facilitating this process for five years now.

"Ocean acidification is a growing international problem that affects all Member States either directly or indirectly", said James Orr, Research Director at the Laboratory for Climate and Environment Sciences (LSCE) in France.

The IAEA OA-ICC provides an umbrella for international coordination, building the capacity of states to develop informed responses to this global problem. The Centre's activities compare and standardize methodologies to measure ocean acidification. Its role is also to develop best practice guidelines and promote data access and sharing within the research community. "These activities are crucial to ensure that data, often generated at great cost, is available to all, in a comparable and consistent format," Orr said.

Five years ago, the OA-ICC was launched in Monaco under the IAEA Peaceful Uses Initiative. Since then the project has grown in scale and complexity as IAEA Member States have sought to improve their understanding of how increasing ocean acidification may affect their livelihoods and their ability to report on target 3 of the United Nations' Sustainable Development Goal 14, which specifically addresses ocean acidification.

Intensive fossil-fuel burning and deforestation over the last two centuries has increased atmospheric carbon dioxide by 50 % above pre-industrial values. The global ocean currently absorbs roughly one third of this human-caused carbon dioxide, and its carbonate chemistry is fundamentally altered in the process. By doing so, the ocean undergoes a decrease in pH, referred to as ocean acidification.

Ocean acidification has been recognized as a major threat to marine ecosystems. Concern about its impacts on socioeconomically valuable seafood is increasing world-wide, and nuclear and isotopic techniques are used to study the phenomenon. The techniques have widely contributed to the understanding

of the field both in terms of investigating past changes in ocean acidity and the impacts of ocean acidification on marine organisms.

The IAEA's OA-ICC maintains a comprehensive bibliographic database, with more than 4500 references, and a scientific database with easy access to more than 900 data sets of impacts of ocean acidification on marine organisms. These databases are available for scientists to identify current research gaps and help develop OA-ICC activities to address them.

The Centre supports efforts led by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (IOC-UNESCO) to develop a standardized methodology for countries to report on SDG target 14.3, which will contribute to generating comparable data across the globe.

Developing capacity around the world

Ocean acidification research is complex and interdisciplinary. The OA-ICC, in collaboration with international partners, organizes specialized training courses tailored to local research needs. These courses cover both chemical and biological aspects of ocean acidification, and use the latest methodologies — including nuclear and isotopic techniques — and guidelines to promote best practices. During the past five years, the OA-ICC has trained more than 150 researchers from around the world and enabled more than 60 scientists from developing IAEA Member States to present their work and connect with peers at major international conferences.

The OA-ICC actively supports the Global Ocean Acidification Observing Network (GOA-ON) that aims to increase observations in critical data-sparse areas, such as along the African coasts and within the Indian Ocean, as well as regional ocean acidification networks in Latin America (LAOCA) and Africa .

"The OA-ICC played a key role in developing the LAOCA network and in so doing inspired hundreds of Latin American scientists," said Cristian Vargas, LAOCA co-chair based at the University of Concepción in Chile. "To advance the understanding of ocean acidification, it is essential to have a centre that coordinates and supports the work of the scientific community around the globe."

The Centre also collaborates with the Ocean Foundation, GOA-ON, IOC-UNESCO, the US National Oceanic and Atmospheric Administration Ocean Acidification Program (NOAA OAP), and other partners to develop specialized toolkits designed for research institutes with limited technical infrastructure and capacities.

Striving to raise awareness about ocean acidification among stakeholders, including the use of nuclear and isotopic techniques to assess ecosystem impact, the OA-ICC news stream disseminates daily news on ocean acidification with more than 1000 posts and close to 40

000 visitors from 185 countries per year. Recently, the OA-ICC designed a new IAEA Coordinated Research Project that will allow countries to use a collaborative approach to evaluate the impacts of ocean acidification on key seafood species in several regions of the world.

The OA-ICC has received direct and in-kind contributions from eight IAEA Member States: Australia, France, Italy (the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, ENEA), Japan, New Zealand, Sweden, the United Kingdom and the United States, as well as major international organizations and projects. It is adapting its activities to evolve with this rapidly growing research field and to ensure that resources are used where they are needed most.

"To address the growing concern about ocean acidification, sustained international cooperation and coordination is crucial," said David Osborn, Director of the IAEA Environment Laboratories.

This topic will be discussed at the IAEA's Scientific Forum: Nuclear Technology for Climate: Mitigation, Monitoring and Adaptation, taking place in Vienna, Austria, from 18 to 19 September 2018.

(原文鏈結)

IAEA HELPS RESEARCHERS WORLDWIDE IMPLEMENT SOPHISTICATED ISOTOPE TECHNIQUES TO DATE THE AGE OF VERY OLD GROUNDWATERS

國際原子能總署協助全世界研究者執行複雜同位素技術去鑑定古老地下水之年齡

Rim Trabelsi and her team from the Laboratory of Radio-Analysis and Environment of the National School of Engineers of Sfax in Tunisia sampling very old groundwater in the local aquifers. (Photo: Laboratory of Radio-Analysis and Environment team at the National School of Engineers of Sfax in Tunisia)

Nuclear techniques enable scientists to understand more accurately the age and flow of particularly old groundwaters. This information can prove important for the long-term management of water resources. Groundwater is the main source of freshwater in many places of the world, but it is a limited resource. Many developed and developing countries are actively seeking the best way to use clean groundwater as sustainably as possible, considering the risks associated with water shortage, pollution, or land subsidence. To this end, the IAEA, together with 13 countries, collected over 100 groundwater samples from aquifers worldwide and hosted a meeting in Vienna in June where 19 scientists presented their sampling results.

For assessing the age of very old groundwater, perhaps millions of years old, scientists find out the concentration of naturally-occurring radioisotopes, which decay very slowly and are not disturbed by chemical reactions within water and with surrounding rocks. In such cases, noble gases such as krypton and helium have been used increasingly as age tracers to estimate the time scales involved in groundwater flow. By analyzing the concentration of the certain isotopes, such as krypton-81 or helium-4 dissolved in groundwater, scientists can calculate precise time scales of when water was recharged in aquifers, how fast it flows, and how long it takes to replenish.

Water shortage is a constant problem in Tunisia and much of the available groundwater resources are shared among Algeria, Tunisia and Libya.

“Estimation of groundwater age will be very useful to calibrate existing groundwater flow models, which local authorities will be able to use for the sustainable management of water resources,” said Rim Trabelsi, Professor Assistant at the National School of Engineers of Sfax in Tunisia, who attended the meeting in Vienna. “We appreciate the IAEA’s support for sampling and analysis, and also look to develop our knowledge in the use of isotopes in water resources management through these training courses and meetings.”

A fellow participant, Sibele Ezaki, a researcher at Secretariat for the Environment of the State of Sao Paulo in Brazil, is conducting a study to estimate

the date of groundwaters in the Tubarao aquifer in Sao Paulo State. The Tubarao aquifer faces on an urgent water shortage due to the rapid growth of population and industrial necessities. “Knowing views of other researchers enriched my knowledge in the field of groundwater assessment and allowed me to have a self-critical view of what can be done to improve our research,” said Ezaki. “Our team is hoping to understand the hydrogeological behavior and recharge potential of this aquifer through a clear determination of its age.

Collecting sufficient amounts of groundwater samples and analyzing the concentrations of dissolved noble gases are technically difficult tasks for many researchers. This is because the amount of krypton and helium in groundwater is extremely small and its analysis requires state-of-the-art equipment, which is not easily accessible for many Member States. The IAEA Isotope Hydrology Laboratory in Vienna is one of a few high-throughput laboratories in the world that can analyze the concentration of helium-4 dissolved in very old groundwaters. The Laboratory also operates techniques and equipment that can sample and purify krypton-81 extracted from groundwaters.

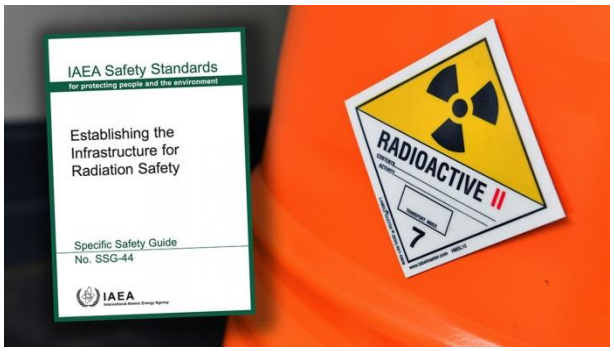
“Understanding the time dimensions of deep groundwater brings us better assessment on groundwater flow models to tackle water needs and problems in various regions” said Takuya Matsumoto, Analyst at the IAEA Isotope Hydrology Laboratory. “Using noble gases for dating groundwater age is relatively new, so we need more samples and case studies to enhance the reliability of this method. This is one of this project’s objectives.”

The outcomes of this meeting are enhancing the understanding of non-renewable groundwater systems, and the Laboratory will facilitate the access to the analytical methods to many Member States. Additionally, the Laboratory will collect additional samples from locations selected at the meeting, sending IAEA experts and using special equipment developed at the Agency. “The IAEA Isotopic Hydrology Laboratory is hoping to help more researchers who need support for sampling and analysis of helium and krypton to ensure data integrity and consistency,” said Matsumoto.

(原文鏈結)

NEW IAEA SAFETY GUIDE PROVIDES ROADMAP FOR ESTABLISHING RADIATION SAFETY INFRASTRUCTURE

新版國際原子能總署安全守則提供建立輻射安全架構之藍圖



A new safety guide designed to help countries build strong radiation safety infrastructure is now available. The guide, part of the IAEA Safety Standards series, supports national authorities in establishing legal and regulatory frameworks to protect workers, patients, the public and the environment against radiological exposure.

The publication, Establishing the Infrastructure for Radiation Safety, outlines actions that help authorities develop and maintain infrastructure in line with IAEA safety standards. It serves as supplementary guidance to the IAEA Safety Fundamentals and Safety Requirements publications.

"The guide provides advice on designing a roadmap that fits the national circumstances for the establishment of a radiation safety infrastructure," said Teodros Gebremichael Hailu, an IAEA radiation safety specialist. "It is intended for use by all Member States, regardless of their level of infrastructure, and recommends actions for measurement, assessment and continuous improvement."

The guide prescribes 67 action items as guidance for all phases of the establishment and implementation of radiation safety infrastructure, including the development of a legal framework for safety and creating a system for radioactive waste management and decommissioning.

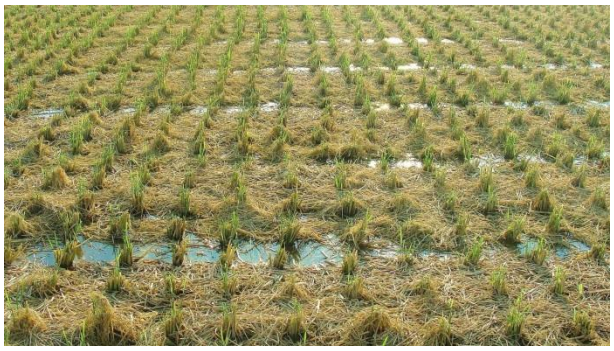
"Establishing legislation for radiation safety can take time, and this guide presents some of the preliminary actions that could be implemented within the existing legal framework," said Hailu.

The guide recommends, for example, that countries appoint a steering group to review national circumstances and advise the government on establishing or strengthening the infrastructure for radiation safety, including by drafting a national policy and strategy for radiation safety.

The IAEA Safety Standards, developed in cooperation with Member States, serve as a global reference for protecting people and the environment and contribute to a high level of nuclear and radiological safety worldwide.

(原文鏈結)

RICE FIELDS IN CHINA DOUBLE YIELDS BY "RATOONING"
中國稻田藉由再生栽培方式增加一倍產量



Just as grass lawns regrow after they are mowed, rice fields can regrow after they are harvested. This second harvest – known as a ratoon crop – has traditionally yielded only a small fraction of the first harvest. But farmers in China are now benefitting from laboratory and field studies conducted by the Joint FAO/IAEA Division that used nuclear techniques to determine the best rice varieties and the best fertilizer regimes for increasing second harvest yields, often resulting in second harvests as large as the first – meaning the farmers who ratoon correctly are doubling their yields – and their income.

The word "ratoon" meaningfully can be traced to two Latin words: retonsus which means "to cut down" and retono which means "to thunder back". It's meaningful because when ratoon is used in relation to agriculture, it means both: a crop is "cut down" at harvest, but its roots are left behind and from that stubble, a second crop "thunders back". Although, realistically, it's only been recently – thanks to an increased focus on fertilizer management and plant breeding – that the second "ratoon" crop has returned with any kind of thunderous energy.

Not all crops can regenerate. For example, maize cannot produce a second crop, but sugarcane, sorghum, pigeon pea and, importantly, rice can. The Joint FAO/ IAEA Division began working on improving the outcome of rice ratooning – also called "stubble cropping" – in China's Fujian Province in 2012. This included studying fertilizer and water management practices for Jiafuzhan, an early maturing rice variety developed by Chinese plant mutation breeders.

Appropriate fertilization: for economic and environmental results

In addition to working with China's mutation breeders to develop and promote climate-resilient early-yield varieties, the Joint Division used nitrogen-15 stable isotope tracing to determine the optimum application rate for nitrogen fertilizers. Both the nitrogen-15 technology and the mutation induction for developing improved varieties were monitored and fine-tuned in the Joint Division's Agriculture & Biotechnology Laboratories in Seibersdorf, Austria, and then applied in the farmers' fields.

The nitrogen-15 technology was able to discern how well the main crop had absorbed the fertilizer, how much was left in the field after the first harvest, and how much more would be needed for the ratoon crop. A major goal is to avoid over-application, which, in addition to being an unnecessary expense, could have environmental implications if the fertilizer is converted as a greenhouse gas and emits into the atmosphere or is washed away and becomes a water pollutant. In this study, the optimum fertilizer application needed for their ratoon harvest was 150 kg of nitrogen per hectare.

Efficient and economic ratooning requires developing and adopting crop varieties with high ratooning capability plus following the fertilizer management practices prescribed by the study. Success depends on the two being combined. The study found that farmers who adopted the combination of improved varieties and fertilizer management saw yields almost double from 6.7 to 12.3 tonnes per hectare. The only expense they incurred for the second crop was buying the required amount of supplemental fertilizer and the only labour required was having to spread the fertilizer, no replanting was needed.

Once the results were known, other farmers were eager to adopt the improved varieties and fertilizer management practices, and now ratooning is underway on 42 000 ha. In addition to nearly doubling rice yields, the farmers in Fujian Province saw their profits increase by USD 3 260 per hectare, which, combined with a 30 percent decrease in the cost of fertilizer, has proven extremely beneficial to the province.

In the past, many upland farmers had ratooned their rice crops, based solely on their awareness that a second harvest was possible. But their second harvest was much smaller than the first, sometimes dropping from 3 tonnes per hectare to 0.5 tonnes per hectare. At that time, they were happy even with a small second harvest. But now they know that with proper management, their ratoon crop can be almost equal to their main crop.

The success in China has indicated that improving ratooning yields also has potential for other rice-producing countries in Asia. They know what they will need: a rice variety bred for high ratooning capabilities, and nitrogen management which uses tracing studies to determine the amount of fertilizer needed to support a high yielding second harvest.

(原文鏈結)

NEW CRP: A STUDY OF E-LEARNING FOR TEACHING AND ASSESSING COMPETENCY IN CONTOURING (E33041)

新偕同研究:針對腫瘤輪廓繪製教學與評估能力之電子學習研究

IAEA staff present a poster about the previous CRP at the Estro 37 conference in Barcelona. (Photo: E. Zubizarreta/IAEA)

The IAEA is launching a new 2-year Coordinated Research Project (CRP) to measure the impact of instructor-led virtual learning on achieving uniformity in radiotherapy contouring practices. The study, which is focused on multidisciplinary staff in low and middle-income countries (LMICs), will seek to determine how the benefits seen from blended learning are maintained when local imaging is used.

Contouring is a key skill used by radiation oncologists when planning for the accurate, precise and consistent delivery of radiation to patients with cancerous tumours. The process uses specially designed computer software to generate 3D images of a patient's body from medical scans taken using diagnostic imaging tools. These images allow first for the identification of the location and size of cancerous tumours, and second for the outlining of healthy organs. Once these steps have been accomplished, oncologists can better plan, based on tumour size and depth, where radiation should be delivered and how much is needed. This minimizes the exposure to healthy tissues and organs. The more accurately a tumour can be contoured, the more likely the desired treatment goals will be achieved.

The field of radiation oncology has evolved rapidly in recent decades in terms of innovations in treatment equipment, volumetric imaging, information technology and increased knowledge in cancer biology. New delivery technologies and associated imaging modalities have enabled highly optimized precision radiation therapy and supported improvements in tumour control and cancer patient cure.

Concepts and terms for the definition of Gross Tumour Volume, Clinical Target Volume and Organs At Risk (OARs) have continued to advance, in part through a series of International Commission on Radiation Units and Measurements (ICRU) reports, becoming widely disseminated and accepted by the European and international radiation oncology community. The selection and contouring of target volumes – both organs and tumours – and OARs has become a key point in modern radiation oncology. However, despite ICRU reports and guidelines from international organizations such as the European Society for Radiotherapy and Oncology (ESTRO) and the Radiation Therapy Oncology Group, clinical research on single institutions and multicentre experiences has suggested

major variations in contouring for both for target volumes and OARs.

Education and training in contouring is therefore a major learning objective for the radiation oncology community. It is especially relevant in developing countries which have only recently transitioned from 2D to 3D planning and as a result, where less of a trained establishment exists. E-learning is appealing in this situation, particularly when the resources required to attend international live courses are limited. To this end, the CRP will build upon the results of a previous IAEA-ESTRO joint project - Quality Assurance of Volumes Definition for Three-Dimensional Treatment Planning - in which the benefit in accuracy achievable by blended leaning for oncologists in LMICs was demonstrated.

CRP Overall Objective:

The primary objective of this CRP is to enhance the quality of contouring of target volumes and organs at risk for 3D conformal radiotherapy in LMIC countries through online education and training workshops.

Specific Research Objectives:

- To determine whether the benefits seen from blended learning using 'textbook' cases are maintained when local imaging from LMIC facilities are used in training workshops;
- To determine whether the benefits seen from blended learning are maintained and reproducible in further anatomical disease sites;
- To train multidisciplinary staff in LMICs who are increasingly involved in the delineation of OARs to contribute to the goal of high quality 3D radiotherapy;
- To evaluate the impact of online blended learning on patient dosimetry and determine what clinical benefit can be predicted.

How to join the CRP:

Please submit your Proposal for Research Contract or Agreement by email to the IAEA's Research Contracts Administration Section, using the appropriate template on the CRA website.

For further information related to this CRP, potential applicants should write to the Research Contracts Administration Contact Point.

This is just one of the many ways nuclear technology is used to improve human health and quality of life – and will be one of the subjects discussed at November's IAEA Ministerial Conference on Nuclear Science and Technology.

(原文鏈結)

核能署每月新聞稿-2018 年 8 月

Hungarian Minister János Süli visits the NEA to discuss the Paks project

匈牙利部長拜訪核能署討論 Paks 計畫

János Süli, Hungary's Minister without Portfolio, responsible for the Paks Nuclear Power Plant expansion, **Becskeházi Attila Csaba**, Secretary of State for infrastructure development, innovation and localisation related to the maintenance of the capacity of the Paks Nuclear Power Plant, and **Ambassador Zoltán Cséfalvay**, Permanent Representative of Hungary to the OECD, visited the NEA on 26 June 2018 for high-level discussions. The Hungarian delegation met with NEA Director-General William D. Magwood, IV, and senior staff to provide the NEA with updates on the Paks Nuclear Power Plant project. Discussions also addressed electricity system costs and the decarbonisation of electricity systems. The NEA wishes to thank the Hungarian delegation for the visit which enabled detailed exchanges of information and ideas.

(原文鏈結)