

IAEA 動態報告

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MYANMAR USES NUCLEAR TECHNIQUES TO IMPROVE INDUSTRIAL PROCESSES

緬甸使用核技術改進工業製程

Yangon, Myanmar – Experts are rolling out the use of nuclear technology in industrial testing across Myanmar, following the successful implementation of the technique in the oil and gas sector.

Non-destructive testing (NDT) using nuclear

techniques involves the use of ionizing radiation to test the quality of materials and products. It plays a vital role in the production and maintenance of materials and structures, without causing any damage to them or leaving any radioactive residue.

報告摘要 (KEY INFORMATION)

1. 緬甸仰光 – 專家們在石油和天然氣部門成功實施新技術後，正在緬甸推廣核技術在工業測試中的應用。
2. 玻利維亞人(Bolivia)在核技術的幫助下，找到了保護和可持續利用 Purapurani 含水層水的方法。
3. 2017 年至 2021 年，原子能總署在人體健康部推出名為應用生物劑量學的協調研究項目，該項目將匯集一些機構，朝著提高使用核技術的質量之目標邁進。
4. 經過多年的暴力和伊波拉病毒的破壞，塞拉利昂(Sierra Leone)的政府衛生部門現在正在將注意力轉向癌症患者人數的增加，並決定在原子能總署的支持下在弗里敦附近的新醫院設立放射治療和核醫學服務。
5. 智利(Chilean)的犯罪調查警察 (PDI) 在原子能總署的幫助下，使用核技術調查 2016 年 6 月在首都聖地亞哥被舉行的學生抗議活動中損壞的殘骸以確認圖的年齡和起源。
6. 2016 年 11 月 28 日至 12 月 2 日，NEA 署長 William D. Magwood 先生在日本與各部和主要機構長官舉行了參訪會議，發表了關於「國際間核裁決」的演講，並與早稻田大學的學者就核能技術問題和 NEA 的工作交流進行了討論。
7. 2016 年 12 月 6 日，國家能源局和韓國放射性物料管理局在「放射性物料和核燃料管理領域」簽署了備忘錄，以促進雙方之間的合作。



The technique called gamma process tomography used in Myanmar is based on the differential absorption in different materials of gamma rays emitted from a radioactive source. Since 2013, the IAEA has helped the country's Department of Atomic Energy purchase the necessary equipment and build the expertise of its staff to use the technique. Department experts regularly perform NDT in the Thanlyin oil refinery near Yangon to inspect the quality of pipes as well as of the products flowing in them.

“Nuclear science and technology play a major role in bringing innovation and efficiency to industrial processes,” said Meera Venkatesh, Director of the Division of Physical and Chemical Sciences at the IAEA. “Myanmar provides a great example on how low-income countries, too, can take advantage of this technology.”

Oil pipes, boilers, pressure vessels, buildings, aircraft equipment and ships are among the products whose quality is tested with the technique worldwide, and Myanmar's Atomic Energy Department is taking steps to spread its use, said Ingyin Phyu, the scientist in charge of the Department's NDT laboratory. “NDT inspections including those using nuclear applications are crucial in the quality control of various industrial fields in Myanmar,” she said.

Technical staff of Myanmar Railways, Myanmar Shipyards, Yangon Technological University and private companies have recently received training on the use of the technique and have already employed it in a wide range of activities, including on construction sites, in dockyards, on locomotives and at the country's largest amusement park.

“The use of NDT greatly enhances the shipbuilding and ship repair sector,” said U Myint Zaw, Deputy General Manager and senior NDT inspector at Myanmar Shipyard. “It is essential for the improvement of our industrial processes and products and we use it extensively for quality control.”

MANAGING WATER RESOURCES: BOLIVIA UNCOVERS AQUIFER'S SECRETS WITH NUCLEAR TECHNOLOGY

管理水資源：玻利維亞揭開含水層核技術的秘密



Bolivians have found ways to protect and sustainably use water from the aquifer of Purapurani — with the help of nuclear technology.

Despite centuries of supplying water to the cities of El Alto and Viacha near the capital of La Paz, little had been known about Purapurani until recently. Scientists are now using isotopic techniques to gather key information about the age, quality and source of this water hidden underground, information that will allow them to better plan its use.

Watch the video of this story here.

“Thanks to isotopes, we are unveiling our aquifer’s secrets,” said Paola Mancilla Ortuño, hydrologist at the Ministry of Environment and Water. “Now we know that in the northern area of the aquifer, water at shallow levels is sadly contaminated. We also know that part of the water in the eastern area is possibly over 2000 years old. And we also know that groundwater in another part of the aquifer comes from rainwater in the Andes Mountain Range.”

Purapurani is a key resource for development in the area, and more than a million people depend on this 300 km² aquifer. “The two cities have developed economically thanks to Purapurani,” Mancilla Ortuño said. A growing population relies on it for everyday use, companies draw heavily from it to keep up with urban expansion, and farmers need it to sustain their crops and livestock.

The IAEA has helped Bolivia establish its first isotope hydrology laboratory, and since 2012 IAEA experts have been training a group of Bolivian scientists on the use of isotopic techniques to assess water resources and determine their origin, age, vulnerability to pollution, movement and interactions, both above and below ground (see The Science box). “Isotopic techniques give us useful information that we could not get from other methods. This gives us a wider vision,” Mancilla Ortuño said.

The improved capacities allow scientists to answer questions they could not properly address before: How old is the water and where does it come from? Is it still of good quality? How much of it is left? The answers to these questions help advance scientific research on Purapurani and shape water protection and management policies to reflect the aquifer’s potential and limits.

What they studied and found

Bolivian scientists study the water's age because it indicates roughly how long it takes the aquifer's resources to replenish — in this case, thousands of years — and helps estimate the aquifer's supply limits. Similarly, they check for contaminants to determine threats to the aquifer that could jeopardize its future use. At Purapurani, contamination has only been identified in a limited area of the aquifer and is likely related to river water mixing with aquifer water.

“Now that we know where the water comes from, we have to protect the aquifer's sources to ensure its sustainability and quality,” said Rafael Cortéz, Consultant for the Ministry of Environment and Water and lecturer at San Andrés University. As the next step, he and his team of scientists plan to build artificial water recharge schemes to guarantee a stable supply of rainwater.

Two worlds

Working with the IAEA has yielded another benefit to Bolivia: a multidisciplinary team of chemists and hydrologists.

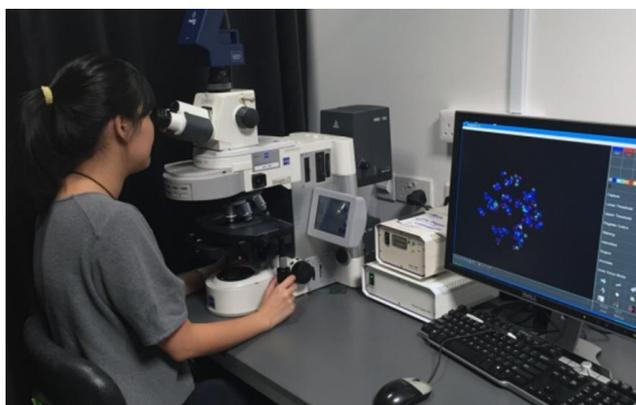
“With these projects we are bringing together experts from different disciplines, hydrologists and chemists,” said Luis Araguás Araguás, isotope hydrologist in the IAEA's Division of Physical and Chemical Sciences. “A hydrologist doesn't usually study isotopes, and a chemist doesn't usually study water resources. Thanks to our projects, they meet and exchange their expertise.”

The team is now working to apply isotopic techniques to the aquifers of the city of Oruro and to replicate the same studies in other cities of Bolivia. Bolivia has five main large urban aquifers, but only three have been studied so far. The recent hydrological studies supported by the IAEA are gaining attention in conferences at the national level and universities have now introduced the concept of isotope hydrology in their curricula.

“We've grown with each project,” Cortéz said. “We have crawled, stood up, learned to walk, and are now starting to jog.”

APPLICATIONS OF BIOLOGICAL DOSIMETRY METHODS IN RADIATION ONCOLOGY, NUCLEAR MEDICINE, DIAGNOSTIC AND INTERVENTIONAL RADIOLOGY

生物劑量學方法在放射腫瘤學、核醫學、診斷和介入放射學的應用

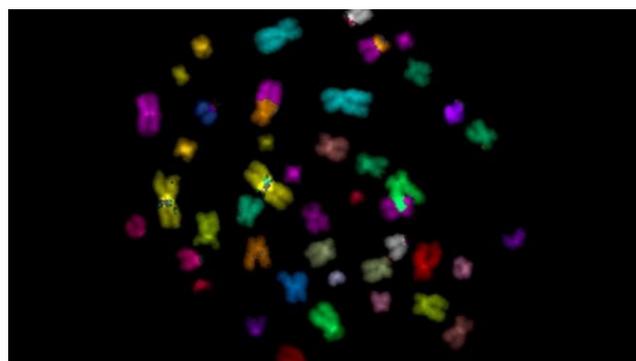


The Coordinated Research Project (CRP) E35010 titled “Applications of biological dosimetry methods in radiation oncology, nuclear medicine, diagnostic and interventional radiology” (MEDBIODOSE) is being launched in Section of Applied Radiation Biology and Radiotherapy, Division of Human Health at the Department of Nuclear Sciences and Applications of IAEA. The CRP will start in 2017 and end in early 2021.

Improving the quality of health with biological dosimetry

Biological dosimetry is one of the most developed branches of radiobiology; its technical aspects, particularly those relevant to cytogenetic assays, are well refined and have reached the level of the international

standardisation. The aim of this CRP is to address various uses of biological dosimetry methods in radiation oncology, nuclear medicine, diagnostic and interventional radiology. It will include filling in gaps in knowledge and developing new approaches to assist with the transition to personalised medicine. The project will bring together a number of institutions to progress toward the common goal of improving the quality of health care using radiation technologies.



How to apply

Applications are invited from institutions in IAEA Member States for Research Contracts or Agreements. Please see more information about CRPs and application process at the “How to participate” page. The deadline for applications is 28 February 2017.

SIERRA LEONE RECOGNIZES CANCER AS PUBLIC HEALTH EMERGENCY

塞拉利昂共和國體認到癌症是公共衛生緊急事件



After years of violence and the devastation of Ebola, Sierra Leone's health professionals can finally look beyond urgent crises. The government is now turning its attention to the increasing number of citizens suffering from cancer and has decided to set up a radiotherapy and nuclear medicine service in a new hospital close to Freetown, with support from the IAEA.

At the government's request, an IAEA expert mission reviewed the country's cancer control capacity last month and will subsequently provide detailed recommendations to the national health authorities, which will form the basis for a national cancer control strategy.

"Cancer is one of the leading causes of death in the country and must be treated as a public health emergency, like any other disease concerning the public's health," said Brima Kargbo, Sierra Leone's Chief Medical Officer. "We must immediately establish the necessary structures to address this as a priority." He also underlined the need for a national cancer control steering committee to develop a national cancer control plan.

The team of international experts who reviewed Sierra Leone's cancer control capacity was nominated by the IAEA, the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC). Such assessments, known as impACT reviews, are often the first step an IAEA Member State takes to understand the scope of its cancer burden and develop a national cancer control strategy.

As part of the review, the cancer experts visited public and private healthcare facilities, medical schools and liaised with health organizations to appraise the key areas of cancer control: prevention, early diagnosis, treatment and palliative care along with cancer planning, data collection and the safe application of radiation medicine with regard to health workers and patients.

What the experts found

It is estimated that almost 3,000 people develop cancer each year in the country, and over 2,000 die from the disease. They are largely preventable or curable if discovered early.

Nonetheless, the majority of cancer patients in Sierra Leone seek medical attention when their illness is far advanced or at an incurable stage because of limited access to early diagnostic services.

There are no radiotherapy services in the country and the provision of other modalities of cancer treatment, such as surgical oncology or

chemotherapy, is hampered by a severe lack of human resources and medical equipment. This limited access to cancer care services, including qualified staff, means that patients have poor chances of survival if they develop the disease.

The imPACT experts recommend developing a comprehensive cancer control plan, including necessary palliative services with relevant training for health care professionals to make sure patients receive effective pain relief.

They visited the Melvine Edith Patricia Stuart Trust (MEPS) Well Women Clinic, one of the few clinics that offers clinical breast screening and prevention programmes and that refers patients for cancer treatment.

The non-profit organization witnessed rising demand for support from 1,500 women in 2009 to over 6,000 in 2013, said Director Jennifer Renner-Thomas, but at the same time saw its funding diverted towards dealing with the Ebola

emergency. “Awareness and education activities were suspended, as were our screening and treatment services for cervical cancer, and the patients we see require palliative care.”

The team commended Sierra Leone’s commitment to provide access to radiotherapy treatment as a key priority, while re-building and training the country’s health workforce to support the new facilities.

Kargbo said that the recommendations from the imPACT review will help to prioritize cancer control interventions in Sierra Leone and facilitate collaboration among the relevant organizations.

NUCLEAR TO HELP CHILEAN POLICE INVESTIGATE CASE OF DAMAGED CHRIST FIGURE

核技術幫助智利警察調查受損害的基督圖



Uncovering the age and origin of a vandalized statue of Christ in Chile could come down to atoms. Chile's Crime Investigation Police (PDI), trained and equipped with the help of the IAEA, are using nuclear techniques to study the remnants of the figure damaged during a student protest in June 2016 in the capital Santiago de Chile.

“This case of vandalism has caused turmoil countrywide,” said Francisco Torres Roquer, Head of the Microanalysis Department of Chile's PDI. The analyses aim to confirm the age and origin of the figure, he said. Determining the historical value of the statue is an important element in the ongoing investigation.

Pursuing criminals with nuclear technology

With advances in technology, criminals have developed more sophisticated methods that make it harder for prosecutors to track evidence. Nowadays, the evidence they leave is so scarce and microscopic that investigators refer to it as ‘trace evidence’.

Nuclear techniques like X ray spectroscopy, X ray diffraction or neutron activation analysis (see The Science box) offer investigators the possibility to analyse this trace evidence with

precision. Not only can these techniques be applied to very small samples, but in most of the cases they do not destroy the evidence, which is why specialists often use them to check works of art, historical artifacts and crime-related forensic samples.

Not destroying the evidence is a key requirement. Regulations demand that both the prosecutor and the defendant should have access to it. “But any study of evidence using conventional methods involves altering the sample's chemical elements or even destroying the sample, which does not allow the other party to analyse it and results in legal disadvantages,” Torres Roquer said. “It's a big problem for us.”

To overcome this, PDI requested support from the IAEA to increase the accuracy of its evidence analysis, complementing their conventional methods with nuclear technology. The IAEA worked with PDI and the Chilean Nuclear Energy Commission, providing spectroscopy machines and training in X ray fluorescence, X ray diffraction and neutron activation analysis. These techniques were used to identify the pigments used in the production of the figure of Christ.

PDI is also using these techniques in other criminal investigations related to pieces of art, including stealing and falsification. They also use them to study the composition of gunshot residue particles —usually taken from suspects— or to establish the composition of materials adhered to bullets to trace their trajectory. Similarly, police can use these techniques to identify minerals in samples of

soil and sediment residues and compare them to minerals taken from the soil and sediments of the suspected crime scene.

IAEA technical cooperation projects have supported the establishment of a national network of forensics experts using non-

destructive nuclear techniques to characterize, identify and analyse forensics samples. This national network is coordinated by PDI and includes the Chilean Nuclear Energy Commission, the University of Chile and the University of Concepción.

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核能署每月新聞稿 - 2017 年 1 月

NEA DIRECTOR-GENERAL MEETS WITH KEY INSTITUTIONS IN JAPAN AND AT FNCA MINISTERIAL

NEA 署長與日本主要機構及 FNCA 部門的長官會面



From 28 November to 2 December 2016, NEA Director-General Mr William D. Magwood, IV was in Japan for a series of meetings with various ministries and institutions, including the Cabinet Office, the Ministry of Foreign Affairs, the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Ministry of Economy, Trade and Industry (METI), the Nuclear Regulation Authority (NRA), the Nuclear

Damage Compensation Facilitation Corporation (NDF), the Japan Atomic Energy Agency (JAEA), the Japan Atomic Industrial Forum (JAIF), the Japan Nuclear Safety Institute (JANSI) and the National Institutes for Quantum and Radiological Science and Technology (QST). On 30 November, he delivered a keynote address on “Stakeholder Engagement in Nuclear Decisions” on the opening day of the 17th FNCA Ministerial Level Meeting. On 1 December, Mr Magwood gave a lecture and held discussions with students at Waseda University on nuclear energy technology issues and the work of the NEA. He also visited the National Institute of Technology at Fukushima College.

MOU TO ENHANCE CO-OPERATION BETWEEN THE NEA AND KORAD

MOU 加強 NEA 和 KORAD 之間的合作



On 6 December 2016, the NEA and the Korea Radioactive Waste Agency (KORAD) signed a Memorandum of Understanding (MOU) in the Area of Management of Radioactive Waste and Spent Nuclear Fuel, fostering co-operation between both parties. A signing ceremony was held in the presence of Dr Jong-In Lee, KORAD President and Chief Executive Officer, and Mr William D. Magwood, IV, NEA Director-General. The MOU specifically aims to facilitate and support co-operation within the framework of the NEA Radioactive Waste Management Committee (RWMC) activities.