

2017/3/20

IAEA 動態報告

2017/3/6- 3/17

HOW THE UNITED KINGDOM SEEKS TO ENHANCE NUCLEAR SECURITY WITH THE HELP OF IPPAS

英國如何利用 IPPAS 的幫助加強核安全

In October 2011, an IAEA team of international nuclear security experts conducted an International Physical Protection Service mission (IPPAS) to the United Kingdom. They visited the Sellafield civil nuclear site, as well as Barrow Port, which is used for the transport of nuclear material. The IAEA conducted a follow-

up mission in February 2016.

IPPAS missions provide advice on how to improve the effectiveness of a State's physical protection regime, either nationally or at facility level. They do so by comparing it with relevant international legal instruments, guidelines and best practices, particularly the 2005

報告摘要 (KEY INFORMATION)

1. 自 1996 年第一次訪問以來，已服務滿 20 週年，IPPAS(International Physical Protection Service mission)一直在幫助成員國確定如何加強保護其核材料和設施，以防止未經許可的拆除和破壞。在此期間，有來自世界各地的 140 多名專家參加。
2. 太陽能技術和輻射治療將可受益於新開發的方法，更進一步地理解游離輻射對電子設備的影響，該技術可以幫助預測這些設備的壽命。
3. 孟加拉(Bangladesh)使用核技術生產的新品種稻米幫助孟加拉在過去幾十年中將水稻產量增加了三倍，使孟加拉的稻米供應安全穩定，該國正從進口國轉變為稻米出口國。
4. 羅馬尼亞(Romania)建立了一個更強有力的核監管系統，該項目加強了羅馬尼亞國家核活動控制委員會(CNCAN)的輻射防護、應急準備與知識管理。
5. 國際原子能總署在三月慶祝了世界婦女節，在一個討論會中分享了一些女士在核技術專業領域中獲得成功的經驗。
6. 核能署(NEA)與國際原子能總署(IAEA)合作舉辦了關於優化核退役安全效率與當前新型方法的講習班，它為參加的專家提供了經驗教訓和交流信息的機會。
7. 核能署(NEA)運行安全專家組舉行了一次技術會議，討論管理放射性物料業務之地質處置庫危險事件與國際業務危險清單，並與成員討論了各國家計劃中考慮的隱藏危害及其相關風險。

Amendment to the Convention on the Physical Protection of Nuclear Material and the IAEA Nuclear Security Series guidance publications.



“The missions have been valuable in allowing the UK to draw upon the expertise of the IAEA and other Member States in a range of disciplines across nuclear security,” said Robin Grimes, Chief Scientific Adviser to the Foreign and Commonwealth Office. “They have identified areas of good security practice that the UK can share with others.”

The 2011 mission team included experts from seven IAEA Member States — Canada, France, Germany, the Netherlands, Slovenia, Sweden and the United States of America — as well as from the IAEA Secretariat. They had extensive experience in various areas of nuclear security, including legislative and regulatory practices, physical protection, transport security, security culture, policing and contingency planning. They performed a national level review of the legal and regulatory framework, as well as a review of the security measures and procedures in place to execute this framework at facilities and during transport.

“The mission underlined the importance of nuclear security, including security culture, for

the nuclear industry and promoted discussion of this issue within the industry,” Grimes said, adding that IPPAS missions were “one of a number of ways in which the British Government demonstrated to the public its commitment to nuclear security.”

The follow-up mission reviewed the actions taken in response to the 2011 mission’s recommendations and provided further advice.

“The follow-up mission also aimed at evaluating the current status of the UK’s physical protection regime of nuclear material and nuclear facilities, as well as its implementation at Heysham nuclear power station,” said Arvydas Stadalnikas, Senior Nuclear Security Officer at the IAEA. The mission sought to provide further advice to enhance the UK’s nuclear security regime, as well as identify good practices that could be beneficial to other Member States, he added.

The follow-up mission team included experts from Canada, France, Lithuania, the Netherlands, Switzerland, the United Arab Emirates, the USA and the IAEA.

“The UK was very happy to welcome two IPPAS missions because of the commitments regarding the confidentiality of sensitive information made by those taking part in these missions,” Grimes said. He added that the UK does have in place a robust and effective security regime for its civil nuclear industry; however, it seeks to achieve continuous improvement in this regime. “We strongly encourage other States to consider inviting an IPPAS mission,” he said.

This year is the 20th anniversary of the service. Since the first mission in 1996, IPPAS has been helping Member States identify ways to strengthen the protection of their nuclear materials and facilities against unauthorized removal and sabotage. During this period, the IAEA has conducted 75 IPPAS missions in 47 countries and at the IAEA laboratories in Seibersdorf, with the participation of more than 140 experts from around the world.

States that have recently hosted IPPAS missions include Albania, Canada, Japan, Malaysia, New Zealand, Norway, Poland, Sweden and the United Arab Emirates. Several others, including Australia, China, the Democratic Republic of the Congo, Germany, Hungary, Jamaica, Lithuania, Madagascar and Turkey have requested IPPAS missions for 2017.

“The significant increase in the number of requests for IPPAS missions demonstrates that this independent international advisory service is being recognized for its value in the exchange of views and advice on nuclear security,” Stadalnikas said. “IPPAS’ 20-year anniversary

marks significant achievements, which are an incentive for the IAEA to continuously enhance this service to make it more beneficial to Member States.”

The IAEA has established a database of good practices identified during IPPAS missions and made available with consent from host countries. It is accessible to Member States through the IAEA Nuclear Security Information Portal.

NEW METHODOLOGY PAVES WAY FOR PREDICTING THE LIFETIME OF ELECTRONIC DEVICES EXPOSED TO RADIATION

新方法為預測暴露於輻射的電子器件之壽命鋪了道路



Solar technology and radiation therapy could benefit from a new methodology developed to better understand the effects of ionising radiation on electronic devices. The technique could help predict the lifetime of these devices with the aim of improving their performance.

The methodology is the result of a four-year Coordinated Research Project (CRP) supported by the IAEA, which involved 14 research groups from 13 countries.

The problem

Despite years of research, there are still significant gaps in the ability to predict how radiation affects and damages electronic materials and the electrical properties and performance of semi-conductors.

“Because of the huge variety of devices with very different properties, it is hard to implement an effective general model to quantify the effects of radiation on electronic materials,” said Ettore Vittone, a researcher from the University of Torino. “The results of

the CRP will help us better understand the effects of energetic radiation in electronic materials and improve their quality and durability for long-term use.”

The new methodology takes into account both the immediate and long-term effects of damage on electronic materials and devices working in harsh radiation environments, said Aliz Simon, a nuclear physicist at the IAEA and coordinator of the CRP. “The performance of a detector used to measure radiation from a radiotherapy device, for example, will deteriorate over time. Knowing when its performance starts to decline will help conduct safe irradiation for cancer therapy,” she said.

The new methodology is based on a model that groups existing techniques for investigating radiation effects on semi-conductor devices.

Experimenting on solar cells with ion accelerators

One area where the methodology could come in handy is working on solar cells in satellites, which are exposed to – and can be damaged by – cosmic radiation.

To know how much radiation a solar cell installed to power a satellite could endure, researchers would have to reproduce cosmic ray exposure in experiments on earth. This, however, would be a gargantuan and time consuming task, so they opted for a more

practical approach: evaluating the key parameters of the device materials. To do so, they used ion accelerators—machines that convert atoms into ions and accelerate them into energies of the order of MeV (millions of electron volt), similar to the energies emitted by radioactive nuclei. The device materials are then irradiated with ions from these accelerators. The electric signal induced is analysed and the resulting damage calculated.

The highly energetic ions from accelerators play a dual role in the experiments: they induce damage by penetrating into the material and deteriorating the electronic properties of the device. In parallel to this effect, the ions are also used as probes to measure structural changes because when they interact with the material, an electrical signal is induced and analysed.

Calculating the damage

The electrical signal induced is due to the motion of charge carriers generated by the ions. If the material does not have defects, the charge carriers can cross the whole device and the signal is at maximum. However, if there are defects, they would act as traps along the way and reduce the number of charge carriers

crossing the device. As the number of charge carriers reduces, the electric output signal decreases and the efficiency of the device degrades.

“Since we know where and how many traps the damaging ions generated, we can extract parameters that characterise the radiation hardness of the material and use the parameters to predict how the device will behave in a traditional environment without the need to conduct additional experiments,” Vittone said.

The CRP aimed to develop an experimental and theoretical methodology accessible to any laboratory equipped with ion accelerators. However, at the current, initial stage, the methodology has been established only for low-level damage — when the radiation slightly perturbs the order for the crystalline lattice. The methodology is published in the *Journal of Nuclear Instruments & Methods in Physics Research (NIM B)* and can be found [here](#).

Additional relevant studies by the project members are published in a special section of *NIM B* and on Science Direct.

BANGLADESH TRIPLES RICE PRODUCTION WITH HELP OF NUCLEAR SCIENCE: CONFERENCE ON TECHNICAL COOPERATION

孟加拉利用核科學幫助稻米生產：技術合作會議



Mymensingh, Bangladesh — New varieties of rice made using nuclear techniques have helped Bangladesh increase its rice production three-fold in the last few decades. This in turn has enabled the country to stay one step ahead of its rapid population growth. Today there is a secure and steady supply of rice in Bangladesh, and the country is shifting from being an importer to an exporter of rice. Achieve food security and improved nutrition will be a key theme at the IAEA Technical Cooperation Conference from 30 May to 1 June in Vienna.

“I have more rice for my family, and I now earn almost double with the rice and mustard seed I grow compared to before,” said Suruj Ali, a farmer from Gerapacha village just north of Mymensingh near the border of Bangladesh and India, who grows a new type of rice plant called Binadhan-7. “I also save money because I don’t have to spray as much for insects.”

Binadhan-7 is one of several rice varieties developed by the scientists at the Bangladesh

Institute for Nuclear Agriculture (BINA), with the support of the IAEA and the Food and Agriculture Organization of the United Nations (FAO). It was developed through a process using radiation called plant mutation breeding (see Plant mutation breeding), and has since become a popular rice variety in the northern part of the country where it has helped farmers and workers stabilize their income and find year-long employment.

Globally more than 3000 plant varieties have been developed and released using plant mutation breeding techniques. These mutant varieties will continue to play a key role in meeting global food demands as the world's population rapidly grows and environmental conditions become more challenging. They can also help in averting famine, a major global problem recently highlighted by United Nations Secretary-General Antonio Guterres.

“Many scientists around the world turn to plant mutation breeding because it allows them to harness a natural process toward more quickly homing in on and cultivating desirable characteristics in plants,” said Ljupcho Jankuloski, Acting Head of the Plant Breeding and Genetics Section of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture. “This method saves time and money for researchers, while resulting in the kinds of plants farmers need to cost-effectively keep food on the table and money in their

pockets. For many farmers, these plant varieties are a game changer.”

Helping farmers in northern Bangladesh

What sets Binadhan-7 apart from local rice varieties is its shorter growing time and ability to produce more rice. Local varieties used in the north produce around 2 tonnes of husked rice per hectare and take about 150 days to mature for harvest. Binadhan-7 produces around 3.5 to 4.5 tonnes per hectare and takes around 115 days to be ready for harvest.

“Before Binadhan-7, I used to only be able to grow two crops and would have several months each year without anything, but with Binadhan-7, I can now grow three crops and earn money all year long,” Ali said. He, along with his family of five, lives off 3 acres of land where he grows rice and mustard seed. “I’ve used that extra money to build two new extensions for my house. I hope I can earn enough to send my kids abroad someday.”

Since its first release in 2007, Binadhan-7 has helped to improve the livelihoods of more than 20% of the people living in the northern region, according to BINA.

No meal is complete without rice

New rice varieties like Binadhan-7 help to address the demand for this staple food in Bangladesh. Many of these varieties have been developed to produce more rice when compared to local varieties, which means more food to eat and sell.

“For most Bangladeshi people, a meal is not a meal if it does not include rice. With a projected population of 195 million by 2030, this puts immense pressure on rice production,” said Mohammad Moinuddin Abdullah, Secretary of the country’s Ministry of Agriculture.

More than 36 million tonnes of rice are produced and consumed in Bangladesh each year, making it the fourth largest rice producer and consumer in the world. The country now regularly exports rice in the region.

“We have to adapt all technologies to increase production to ensure food and nutritional security,” Moinuddin Abdullah said. “That’s why we are very keen to have agriculture research through which we get new plant varieties.”

ROMANIA'S NUCLEAR REGULATORY MECHANISM STRENGTHENED

羅馬尼亞核監管機制得到加強



Romania has a stronger nuclear regulatory system following a capacity building project that was completed recently, agreed participants of a roundtable in Bucharest on Friday. The project led to strengthening of the Romanian National Commission for Nuclear Activities Control (CNCAN) in enhancing safety and security, radiation protection, emergency preparedness, knowledge management, inspection processes at nuclear facilities, radioactive waste management and safeguards (See Enhancement of CNCAN capabilities in eight areas).

“Recognizing that nuclear safety is a national responsibility and a global challenge, through international cooperation CNCAN has greatly enhanced its regulatory capacity,” said Grzegorz Rzentkowski, Director of the IAEA Division for Nuclear Installation Safety. By maintaining a clear focus on results, the CNCAN’s regulatory effectiveness has improved, resulting in adequate implementation of regulatory control over nuclear facilities and activities, including verification of compliance with regulations, he added.

The three-year ‘Regional Excellence Programme on Regulatory Capacity Building in Nuclear and Radiological Safety, and Emergency Preparedness and Response in Romania’ was carried out by the Norwegian Radiation Protection Authority (NRPA) and the IAEA. It was financed by Norway, which provided 85 per cent of the over EUR 4 million budget, with Romania contributing the remainder.

“As a result of this project, there is now better control of radioactive material and a reduced risk of accidents,” said Ingar Amundsen, Head of the NRPA International Nuclear Safety Section. (Watch Video interview).

The project implementation required strong commitment and extensive resources from Romanian authorities and partners, said Cornelia Spitzer, Head of the IAEA Safety Assessment Section. (Watch Video interview). Pooling resources and expertise are valuable conduits for capacity building and in some instances adopting novel solutions.

During the two-day meeting last week, over 60 participants received an overview on the activities implemented, the results obtained and gained insights valuable for similar future projects in other countries.

“ The project is proof of an efficient partnership between NRPA, IAEA and CNCAN to address Romania’s nuclear regulatory needs,” Cantemir Ciurea-Ercau, Director of the Romanian National Commission for Nuclear

Activities Control (CNCAN) Nuclear Fuel Cycle Division said. (Watch Video interview).

The project was based on the recommendations of two earlier IAEA review missions to Romania. An IAEA Integrated Regulatory Review Service (IRRS) mission in 2011 produced recommendations and suggestions to

strengthen the regulatory body, and an Emergency Preparedness Review (EPREV) mission in 2010 also made various immediate and long-term recommendations focusing on the improvement of Romania's national emergency preparedness and response infrastructure.

BREAKING BARRIERS, LEADING NUCLEAR EXECUTIVES SHARE THEIR PATHS TO SUCCESS: IAEA CELEBRATES INTERNATIONAL WOMEN'S DAY

打破障礙，領先的核子管理高層分享成功之路：國際原子能總署慶祝國際婦女節



The IAEA celebrated International Women's Day this year with a panel including women who have broken down barriers to achieve success in technical careers at nuclear power plants.

"I am very pleased that the focus is on women who have already achieved a great deal in their careers – and in the field of nuclear power, in particular," said IAEA Director General Yukiya Amano in his opening remarks. "Our panellists are the proof that Breaking Barriers – our motto today – really is possible."

Mr. Amano also voiced his commitment to achieving equal representation for women at all levels at the IAEA.

These women leaders shared their experiences of how they established themselves as the front-runners in an industry where women are under-represented in top positions, especially in technical areas.

"We are in roles that are non-traditional and sometimes being women we have to adjust our behaviours to the situation to some extent and we often have to prove our credibility and capabilities. Expect challenge. We work in an industry where we can make no mistakes," said Amy Ferko, Plant Manager of the Braidwood Nuclear Power Plant (NPP) for Exelon in the United States, and one of the panellists.

“The best advice I got when I started working in the industry is not to be afraid to be the only woman in the room,” said Eva Halldén, Senior Executive Advisor – Nuclear for Vattenfall AB in Sweden.

Other panellists included Satu Katajala, Vice-President of Fortum Generation and General Manager of the Loviisa Nuclear Power Plant in Finland, and Mikhail Chudakov, Deputy Director General and Head of the IAEA Department of Nuclear Energy. The discussion was moderated by Mary Alice Hayward, Deputy Director General and Head of the IAEA Department of Management.

Chudakov, drawing on his experience as a plant manager in Russia earlier in his career, said he believed women are more aware of the need to follow procedures and safety culture and therefore make good operators and shift supervisors. He would like to see more women working in NPPs and within technical positions in the IAEA.

“Things are different now than when I started my career. Today, I have a boss who is a woman, the head of the nuclear regulator is a woman, and the head of nuclear safety in another Finnish utility is a woman,” said Satu Katajala, Vice-President of Fortum Generation and General Manager of the Loviisa Nuclear Power Plant in Finland. “There are so many women taking my nuclear classes at the university.”

The panellists agreed that there are more women working in a range of positions in NPPs than in the past and that what is needed for innovation is a good mix of perspectives from women, men, experienced and junior staff.

In closing, Mary Alice Hayward remarked: “When you’re good, it should not matter what gender you are. There are very few women who have been operators and plant managers at NPPs, and this was a great opportunity to highlight the panellists’ achievements to encourage women to pursue technical careers in the nuclear field.”

NEA MONTHLY NEWS BULLETIN - MARCH 2017

核能署每月新聞稿 - 2017 年 3 月

OPTIMISING SAFETY AND EFFICIENCY IN NUCLEAR DECOMMISSIONING

優化核退役的安全和效率



On 7-9 February 2017, the NEA in collaboration with the International Atomic Energy Agency (IAEA) held a Workshop on Current and Emerging Methods for Optimising Safety and Efficiency in Nuclear Decommissioning, an issue of growing importance for many countries worldwide. Hosted in Norway by the Institute for Energy Technology (IFE) on behalf of the NEA Halden Reactor Project, the workshop was attended by more than 100 participants from 25 countries, representing a wide range of stakeholders, including operators, regulators, scientists, consultants and contractors. It provided an opportunity for the participating experts to exchange information and views on lessons learnt from ongoing and completed decommissioning projects; ongoing and future R&D and collaboration needs; and methods for improving decommissioning strategies. The workshop programme also featured demonstrations of advanced computer-aided technologies in support of decommissioning planning. Participants concluded that the sharing of knowledge and experiences and technology demonstrations at the workshop would be useful for many nuclear facilities worldwide in addressing the existing decommissioning challenges. Workshop presentations are available online at oe.cd/1On

OPERATIONAL SAFETY OF DEEP GEOLOGICAL REPOSITORIES

深層地質遺跡的操作安全

On 6 February 2017, the NEA Expert Group on Operational Safety (EGOS) held a technical meeting to discuss the development of an international operational hazard list for managing hazardous events at operational geological repositories for radioactive waste. Participating members discussed the credible hazards considered in various national programmes and their associated risks, risk assessment techniques and risk management in safety assessments. Recognising the practicality and value of an international hazard list, particularly in ensuring the completeness of safety assessments of geological disposal, the expert group will begin to work on compiling the specific hazards identified in individual national programmes.