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# NS Update

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## Inside



*Denis Flory, Deputy Director General, Department of Nuclear Safety and Security*

# Our increased responsibility

I was appointed at an exciting time, with high expectations from Member States and increased responsibilities for the IAEA in the fields of safety and security, in particular in relation to: access to nuclear energy for new entrants; life extension of nuclear power plants, which is high on the agenda of nuclear-mature countries; the building of new reactor designs, which creates opportunities to strengthen safety worldwide; the essential role the IAEA will have to play as a new generation of reactors progressively enters into operation; the high expectations of the IAEA voiced at the uppermost levels during the conference on nuclear security in Washington concerning the activities; and the IAEA Safety Standards, which are increasingly becoming the basis for legislation in nuclear safety worldwide. This is a very rewarding result of the IAEA's work, but again represents an increased responsibility towards our Member States and the public; a personal "soft spot" for the recently held Tokyo conference on "Challenges faced by technical and scientific support organizations (TSOs) in enhancing nuclear safety and security" (see p. 17); still discovering the many facets of the activities of the Department and of its dedicated personnel; and finally, but no less important, the difficulty and opportunity created by the number of changes at all levels in the Department.

In the weeks and months to come, we will be looking closely at many of these issues, which directly or indirectly contribute to the well-being of millions of people around the world. I very much look forward to working with each of you and to getting to know you better.

*Workers perform a diagnostic procedure at the Cardiac Catheterization Laboratory at San Carlos Hospital, Madrid. Medical work-ers perform more than 10 000 000 procedures per day and comprise the largest proportion of workers exposed to ionizing radiation. In addition, there are increasing reports of patients undergoing multiple diagnostic computerized tomography (CT) scans within a few years or even in a single year.*

# Supporting radiation protection in medicine

The United Nations recognizes the IAEA as the organization responsible for international activities concerned with the peaceful uses of atomic energy, which includes the application of ionizing radiation in medicine. Safety in nuclear applications is paramount, and a core element of safety is setting and promoting the application of international safety standards for the management and regulation of activities involving nuclear and radioactive materials. The key standards in this area are the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, known as the International BSS, which mark the culmination of efforts that have continued over the past several decades towards the harmonization of radiation protection and safety standards internationally. The Standards are being revised with participation from representatives of sponsoring organizations and the IAEA's Member States; this work will result in a fully revised edition. The major categories of medical procedures utilizing ionizing radiation are diagnostic radiology, nuclear medicine and radiation therapy. Radiation protection in medicine includes protecting the persons that are medically exposed as well as the medical workers that are occupationally exposed.

## A global perspective on medical exposures

Medical exposure is defined as exposure incurred by:

- Patients as part of their own medical or dental diagnosis or treatment;
- People, other than those occupationally exposed, knowingly while voluntarily helping in the support and comfort of patients;
- Volunteers in a programme of biomedical research involving their exposure.

The number of people medically exposed on any given day, principally through their own diagnosis or treatment, is staggering. It is estimated that every day, around the world, ionizing radiation is used for imaging of patients in more than 10 million diagnostic radiology procedures and 100 000 diagnostic nuclear medicine procedures, while 20 000 radiotherapy courses are started along with many therapeutic nuclear medicine procedures. Ionizing radiation has for a long time since its discovery proved to be able to bring tremendous benefits when used in medicine and while these advantages are increasing rapidly

overall, they are unevenly distributed around the world. Due to the continuing increase in use, the world's annual per capita effective dose is also increasing rapidly. This is nearly exclusively because of the increasing medical exposure, which is now equal to or exceeding that from natural background in some countries. The global figure for the effective dose per capita from medical exposure was estimated by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) to have increased from 0.3 mSv (1993 Report) to 0.4 mSv (2000 Report), reaching a current value of more than 0.6 mSv (2008 Report). These figures can be seen as an indication that access to radiation in medicine is increasing for the global population.

## Radiation protection issues in medical exposures

Medically exposed patients need to be protected from unnecessary and unintended exposure.

Unnecessary exposure of patients can arise from medical procedures that are not justified for a specified objective, application of procedures to individuals that are not justified on the basis of their conditions and medical exposures that are not appropriately optimized for the situation in which they are used. There is evidence that a substantial percentage of medical procedures using ionizing radiation are lacking in justification and optimization, and thereby that a substantial fraction of the effective dose per capita from medical exposures is unnecessary, bringing an unnecessary risk to the global population due to stochastic effects.

Unintended exposure of patients can arise from unsafe design or use of medical technology. Accidents arising from unintended exposure can lead to deterministic effects or loss of tumour control. A number of accidents involving ionizing radiation in medicine have been reported in several countries over the last number of years, causing either overdose or underdose to a large number of patients.

The IAEA is addressing these radiation protection issues in medicine in the Radiation Protection of Patients (RPoP) Unit in the Radiation Safety and Monitoring Section (RSM) of the Division of Radiation, Transport and Waste Safety (NSRW) in NS.

## The international action plan for radiation protection of patients

A major outcome of the International Conference on Radiological Protection of Patients, held in Malaga, Spain, in March 2001, was a request to the IAEA to formulate an action plan for future work relating to radiation protection of patients. The International Action Plan (IAP) for the Radiological Protection of Patients was prepared and approved by the IAEA's governing bodies in 2002. The overall objective is to make progress in the radiation protection of the patient as a whole. The IAP is ongoing, coordinated by the IAEA and kept under review by a Steering Panel consisting of representatives of international organizations and professional bodies (as well as individual experts) including:

- WHO (World Health Organization)
- PAHO (Pan American Health Organization)UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation)
- EC (European Commission)

– ESTRO (European Society for Therapeutic Radiology and Oncology)
– ICRP (International Commission on Radiological Protection)
– ICRU (International Commission on Radiation Units and Measurements)
– IEC (International Electrotechnical Commission)
– IOMP (International Organization for Medical Physics)
– IRPA (International Radiation Protection Association)
– ISRRT (International Society of Radiographers and Radiological Technologists)
– ISR (International Society of Radiology)
– ISO (International Organization for Standardization)
– WFNM (World Federation of Nuclear Medicine and Biology).

Many actions are taken under the IAP. The types of actions include: (1) providing standards; (2) providing training; (3) providing guidance; (4) facilitating knowledge exchange; (5) giving direct technical assistance; and (6) building awareness. Much progress has been gained over the years in addressing optimization of medical exposure and increasing safety in medical exposure. There has been less progress in addressing justification of medical exposure over the years, but IAEA efforts are under way to address this issue.

## Radiation protection issues in occupational exposure of medical workers

The number of occupationally exposed persons is much greater in medicine than due to any other source or practice, because of the widespread nature and volume of medical procedures. UNSCEAR estimates that there are over 2.5 million monitored workers in medicine (compared to 0.8 in industry and 0.3 as a result of military uses) and that the collective dose is 850 man Sv in medicine (compared to 289 in industry and 45 from military uses).

Individual occupational exposure varies widely for medical workers, with most receiving annual doses well below dose limits, but where some procedures can give substantial doses to medical staff, such as fluoroscopically-guided interventional medical procedures. There are also procedures in nuclear medicine and brachytherapy that require strict attention in order to actively minimize occupational exposure. The IAEA is addressing radiation protection of occupationally exposed workers, including medical workers, through the International Action Plan on Occupational Radiation Protection.

## Some highlights of current actions in radiation protection in medicine

Many of IAEA's activities in radiation protection in medicine are continuously ongoing: providing standards, guidance, training and direct technical assistance as well as facilitating knowledge exchange and building awareness. Under its Technical Cooperation (TC) programme, the IAEA organizes and encourages Member States to participate in projects on radiation protection of patients and protection in medical exposure. Several Member States have national projects while others participate in regional projects under various tasks. More information on how to participate in these projects, as well as much more information on radiation protection of patients, can be found on the dedicated IAEA website on patient protection: http://rpop.iaea.org. Furthermore, a major international conference on radiation protection in medicine is being planned by the IAEA for 2012. Some highlights other current actions in radiation protection in medicine are:

### SmartRadTrack

Cumulative effective doses exceeding 100 mSv, and in some cases 1 Sv, are increasingly being reported for individual patients. It is becoming clear that attention is needed to track the radiation exposure (radiation history) of patients – number of examinations or radiation dose estimations. The IAEA has initiated a "Smart Radiation Tracking" (SmartRadTrack) project for long-term recording of patient doses in diagnostic and interventional procedures, involving a number of stakeholders. Meetings have included representatives of Integrating the Health Enterprises, Electronic Health Record, regulators, experts in imaging and radiation dosimetry, arriving at a common understanding of the purpose of the project, justifications for actions and also in developing recommendations for different stakeholders.

A Technical Meeting was held at IAEA headquarters between 18 and 21 Oct. 2010 to provide a forum for Member States to learn from experts about the project, discuss results of a survey conducted by the IAEA on the current status of patient dose tracking in the world, discuss the recommendations developed and prepare an implementation plan. This meeting also provided the opportunity for Member States to gather material for seeking IAEA-TC assistance.

### Justification of medical exposure in diagnostic imaging

A significant fraction (20 to 50% in some areas) of radiological examinations may be inappropriate in justification. This is a major radiation protection challenge, towards which the IAEA is directing efforts. As a follow-up to the international workshop on justification of medical exposure in diagnostic imaging, held jointly with the European Commission in Brussels (2–4 Sep. 2009), the IAEA held a Technical Meeting at IAEA headquarters between 4 and 6 Oct. 2010 with the aim of reviewing the arrangements to ensure effective justification of medical exposure in diagnostic imaging in the day-to-day practice of hospitals and clinics. In particular, the three key areas (the AAA's) in ensuring effective justification will be explored: *Awareness* to enable effective communication about radiation risk; *Appropriateness* to ensure that those referred for radiological examinations really need them; and *Audit* to check the effectiveness of the referral process and related processes. The Steering Panel of the International Action Plan for Radiation Protection of Patients has recommended the development of an International Campaign on AAA, as a collaborative effort of key players and stakeholders.

### SAFRAD/SAFRON

High radiation doses to the patient can occur in interventional proce-dures and there are reports on deterministic effects (radiation-induced skin injury). There is an absence of international and regional reporting system for radiation injuries arising from these procedures, and a gross lack of national systems in most countries. The IAEA has recently launched a voluntary reporting system called Safety in Radiological Procedures (SAFRAD), where patients submitted to defined trigger levels or events in fluoroscopically-guided diagnostic and interventional procedures are included in an international database, with a primary objective to be an educational system. Enhancing safety in radiotherapy is also of key concern. This complex treatment modality has a low overall associated risk of injury or death from adverse events, but is receiving wide attention on safety related issues. It is generally accepted that one aspect of achieving safety improvement in radiotherapy is through the establishment of a comprehensive global safety reporting and learning system. The IAEA is in the process of developing an educational reporting system for voluntary reporting of safety significant events in radiotherapy called Safety in Radiation Oncology (SAFRON), with the objective of becoming a global safety reporting and learning tool. This tool encompasses retrospective reporting and prospective risk analysis within a learning environment that will improve the safe planning and delivery of radiotherapy. The integration of prospective risk analysis together with retrospective reporting will enable proactive

*Linear accelerators (LINAC) use fast-moving subatomic particles to deliver radiation therapy directly to the tumour for treating patients with cancer.*

measures, which is of value when considering the rapid development of new medical technology.

## Accident prevention and risk analysis in radiotherapy in Latin America

A regional training course on prevention of accidental exposure in radiotherapy and risk analysis was held in Santiago, Chile in 2009. A multidisciplinary group from Latin American countries attended the event, including radiation oncologists, medical physicists and national regulators. Lectures and practical exercises on risk analysis were given with a focus on enabling participants to use these methods in their respective countries. A one-year work plan was designed including exercises to apply the lessons learned in participants' respective radiotherapy departments and implementation of the risk matrix approach. One year later, 12 countries have implemented the risk matrix in their radiotherapy services, taking account of lessons learned, which were evaluated in a workshop in Havana, Cuba (6–10 Sep. 2010).

## ISEMIR

The first Working Group in Interventional Cardiology (2009) within the project Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR) has the mandate to draw up an overview of the situation concerning occupational exposures and radiation protection of staff in interventional cardiology (cardiologists, electro physiologists, paediatric cardiologists and other staff members) all over the world. The working Group aims to identify both good practices and shortcomings and define actions to be implemented for assisting regulatory bodies, medical physicists, medical staff, technicians and nurses, dosimetry service providers and X ray machine providers in improving occupational radiation protection; to propose recommendations for harmonizing monitoring procedures; and to set up a system for regularly tracking occupational doses for these individuals and for disseminating this information.

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*Artist view of Taishan nuclear power plant under construction.*

# Wano's pre-startup support

With nearly 60 nuclear units under construction worldwide, the World Association of Nuclear Operators (WANO) and the IAEA are working closely to ensure every new nuclear power plant starts up safely.

It is their shared expectation that every newly-built unit will receive a thorough, independent review of its equipment and operations by either WANO or the IAEA at least three to four months before any fuel is loaded.

Given the sheer volume of construction, meeting this expectation will be a challenge. However, WANO and the IAEA meet at least twice each year to update the status of their reviews, discuss common issues and share best practices in the way each organization conducts pre-startup reviews. They have also agreed to exchange personnel for pre-startup reviews, when appropriate.

"In the end, whether the review is conducted by WANO or by the IAEA, the goal is the same – the safe and reliable startup of each and every new nuclear plant," says George Felgate, WANO's Managing Director.

For WANO, the ultimate objective is to support its member operating companies from the very start of their preparation for safe and reliable operation all along the time line towards commercial operation. This support will consist of a plan developed by WANO and the utility for technical support missions and peer reviews as construction progresses. The following are items that might be included in such a plan:

## Basic training

A first approach consists of Basic Training providing the fundamental principles to build a strong nuclear operational safety culture. WANO encourages its members to schedule this training as soon as the management team for operation preparation is in place, in order to compensate for the dilution of nuclear experience in the operating organization under construction.

The training package could include the historic operating experience that shaped our industry. By making WANO's vast library of operating experience available, potential safety issues can be identified and fixed long before new plants are ready for operation. Further training items include safety culture, human per-formance, operational decision making, the operating experience process, the newly developed WANO Performance Objectives and Criteria for reviews during the operation preparation phase, and WANO Guidelines and Good Practices. This package will be complemented with train-

ing and technical support missions as requested by the member depending on their specific needs.

Since the preparation for operation is an enormous project scheduled over several years, WANO offers support at different phases of the project. The intent is to review the entire programme setup at a very early stage, to review its implementation as the project progresses and to perform a pre-startup peer review some months before fuel loading. This allows the future operating company to check the comprehensiveness of its approach, the effectiveness of its implementation and its early operational performance during commissioning, with several opportunities to optimize its approach.

## Early programme review

The purpose of an Early Programme Review is to assess the comprehensiveness of the operation preparation programme, by reviewing the programme organization, the schedule, its milestones, its needs for resources, competences, procedures and tools. This is achieved by reviewing the consistency of the organization preparations against these requirements. The scope covers the Human Resources strategy, the job profiles, the recruitment schedules, processes and strategies, and the retention programmes. This involves reviewing the setup of the systematic approach to training, the operating experience process and organization, and the development of the supporting tools.

This early programme review is performed by a small team of experts during a visit of three or four days at the operating company location.

## Operation preparation review

The Operation Preparation Review is designed to review the effectiveness of the implementation of the operation preparation programme. It offers the programme management a snapshot of the moment when preparation activities are at their maximum speed, typically two years before fuel loading, which is some months before the first electrical systems are energized.

The first part of this review includes the buildup of the operating organization, preparation of the documentation package and the development of the supporting IT tools. At this stage the effectiveness of the recruitment and training programmes are assessed. In addition, the preparation of the policies, organization procedures, process descriptions and operational procedures are reviewed, including the data and document transfer from the vendors to the operating company. Engineering and maintenance preparation is also evaluated, including the design base constitution, the technical data management, the maintenance strategy, the maintenance programmes for different equipment, the contracting strategy and the supporting IT tools.

The second part of the review involves field observations of the training delivery to assess the effectiveness of the systematic approach to training. This part of the review gives a first impression of the emerging safety culture among the staff. The scope covers both simulator training and classroom or workshop training, for operations staff as well for all other crafts, and includes general employee training, cultural training and human performance training. The operation preparation review is performed by a team of about 7 experts during a period of 1 week.

## Pre-startup peer review

The final opportunity for support presented here is the Pre-startup Peer Review. This review combines two approaches long applied by WANO: the performance and observation based peer review of field activities and the follow-up review to assess progress made by the operating company to address areas identified during the operation preparation review.

Since the pre-startup peer review is scheduled between 8 and three months before fuel loading, the activities that are observed include commissioning and startup testing, tagging, isolation of equipment, plant status management, equipment and system turnover, configuration management, maintenance, monitoring and operation of systems turned over to the operating company, equipment protection, housekeeping, industrial safety, work management, decision making, and human performance.

In addition, the pre-startup peer review assesses the last phase of the operation preparation. The team evaluates both the progress made since the previous operation preparation review and the status of the preparation in general. Special focus is paid to the emergency arrangements, radiological protection and the preparations the arrival of fuel on site. The scope of this pre-startup peer review requires a team of at least 12 to 14 experts for a period of two to three weeks.

WANO is assigning a limited number of key experts in its organization to attend and follow up on all pre-start activities. They will act as a pre-startup core team that centralizes the experience and feedback from the members. Periodically they will meet as a team to evaluate the WANO approach and to define and implement improvements to WANO products and processes related to pre-startup support.

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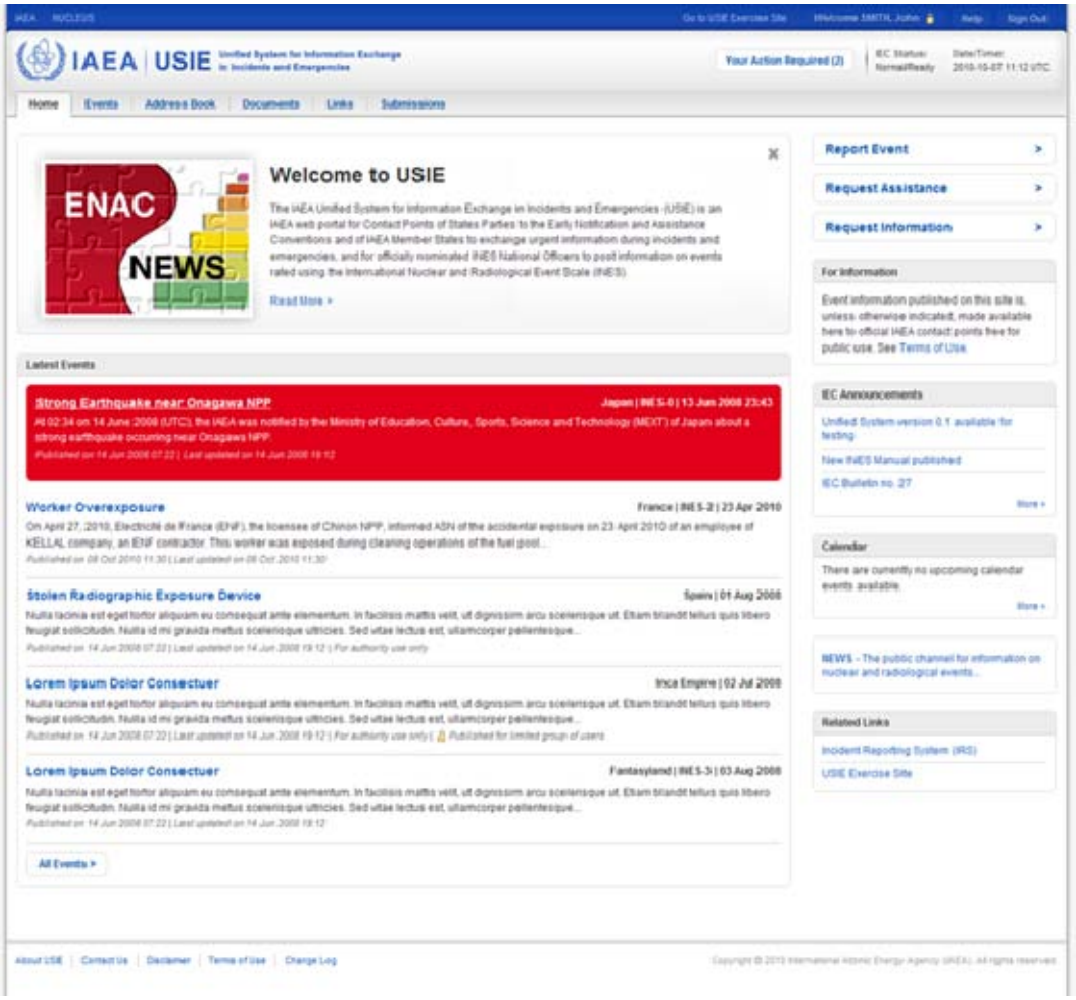



*Prototype of a new system called USIE – Unified System for Information Exchange in Incidents and Emergencies, facilitates reporting and data sharing and is currently in development.*

# One stop for incident and emergency communications

Two primary reporting systems exist at present: ENAC (Emergency Notification and Assistance Convention website) and NEWS (Nuclear Events Web-based System). Both facilitate early and near real-time communication on incidents and emergencies. Both have seen recent event communications duplicated on the other. Indeed they attract different audiences, but those users could all be served by the new *Unified System for Information Exchange in Incidents and Emergencies* (USIE) aimed at combining the functionality of ENAC and NEWS.

Users of the new system include the general public, the media, nuclear regulators, INES (International Nuclear Event Scale) National Officers, National Warning Points working with the IAEA's Incident and Emergency Centre (IEC), National Competent Authorities identified under the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency and the Convention on Early Notification of a Nuclear Accident (Emergency Conventions) and representatives of the Permanent Missions to the IAEA.

ENAC is primarily designed and used for communication of nuclear and radiological emergencies, serving as a key tool under the Emergency Notification and Assistance Technical Operations Manual (ENATOM) arrangements, which clarify the expectations of the IAEA Secretariat for the arrangements between the IAEA, State Parties and Member States. NEWS is mainly used under the INES arrangements to openly share information on recent events rated at INES level two and above and events attracting international media interest.

The new system will host two logically separate interfaces: a protected website available to officially designated users in Member States on which all reporting and data entry are car-

ried out; and a public read-only website through which information entered on the protected website can be channeled to the public. Information entered on the protected website can be channeled to the public read-only site when and if needed. Streamlining communications and avoiding inconsistencies are two key benefits of the new system.

For official users, online forms for requesting assistance, event notification and updating contact information will be features of the new system. For example, Member States will be able to request assistance from the IAEA and its Response and Assistance Network (RANET). In addition, there will be improved and enhanced security features, forms and workflow for event reporting

## USIE Features

### Key features for official users

- Submit notifications and advisory messages to IAEA in emergencies
- Request assistance from the IAEA
- Execute exercise response actions
- Update contact details with IAEA
- Find contact details for officials in Member States
- Submit new and updated incident or emergency information for the public site
- Grant special access to other users.

### Key features for public users

- Research information on nuclear and radiological events, including INES ratings
- Subscribe to receive updated information on events.

# Emergency preparedness in IAEA Member States

## Emergency preparedness and response training

Nuclear and radiological incidents and emergencies do occur. States and the international community have to be prepared to efficiently respond to such events. That is why the IAEA's Incident and Emergency Centre (IEC) continuously refines standards, guidance and practical tools for strengthening States' preparedness and provides training for implementing this guidance and tools at local, national and regional levels.

States turn to the IEC for assistance in strengthening their preparedness for response to nuclear or radiological emergencies. In return, the IEC provides States with detailed practical procedures and associated training that can be readily adapted for specific use.

The IEC offers a range of training courses and workshops to address the needs of identified target groups (see insert). Training for emergency preparedness and response is based on a concept of self-sustaining education and training in Member States. Competence is acquired, developed and maintained through an established programme of training.

## Target groups for emergency preparedness and response training courses

- Decision makers
- Emergency planners
- Emergency response coordinators
- Staff of regulatory bodies
- Radiation protection officers
- Radiological assessors
- Medical personnel
- First responders
- Training officers
- Public information officers

Training in emergency preparedness and response is part of the capacity building efforts of the IAEA to assist Member States in creating sustainable nuclear safety and security infrastructure.

The IEC also supports national courses. The latest example is an emergency preparedness and response course in China. The China Atomic Energy Authority (CAEA) recently organized a four-day course on emergency preparedness and response. Held at the National Nuclear Emergency Response Office (NNERO), the course was attended by 30 senior officials from nuclear emergency response organizations in 16 provinces. The topics discussed included regulations and standards on preparedness and response for nuclear emergencies, emergency planning and management, consequence assessment and policy making, personnel training, exercises and compliance with international conventions.

The IEC was invited to the course and an IEC staff member delivered a lecture on the Emergency Conventions, the role of the IAEA in preparedness and response, and on exercises. The invitation by China and the participation of the IAEA contributed to strengthening international exchange and cooperation in the field and ensuring implementation of relevant international obligations. Experts of the IAEA Integrated Regulatory Review Service (IRRS) team were also present to participate in discussions

## Emergency Preparedness Review (EPREV)

In addition to developing guidance and providing training courses and workshops, Member States have the opportunity to request an Emergency Preparedness Review (EPREV) from the IAEA to independently appraisepreparedness for a radiation incident or emergency. The EPREV service has been offered since 1999 and is based on international standards and best practices. It is not prescriptive, nor is it rigid: it takes into account the practical context in the Member State, emphasizes the positive features of "how things are done" in that country and indicates areas that need additional work.

An EPREV can only be conducted with the cooperation of the Member State. For the host country to get the most out of the appraisal, it will need to be prepared to organize meetings, describe arrangements in detail, provide relevant documentation, tours of activities, and access to equipment used in emergency response.

## Why request an EPREV

- To compare the host country's arrangements with current international standards and best practices;
- To initiate a fundamental reassessment of well-established arrangements that have evolved over time, but that are now thought to contain some inefficiency;
- To benefit from the EPREV team members' experience by considering how other Member States have successfully implemented innovative and effective solutions;
- To ensure that the host country's arrangements are complete at all levels, are practical within the constraints of the local conditions and can be implemented effectively;
- To determine if the legal framework has ensured an appropriate set of arrangements for all types of facility, reflecting the full range of risks to which they apply;
- To highlight the positive and negative aspects of the arrangements;
- To prioritize the aspects requiring improvement, recognizing that resources are limited;
- To highlight the need for additional training;
- To identify possible objectives for future emergency exercises;
- To appraise aspects of the arrangements thought to be inadequate or require an independent review;
- To raise the profile of emergency planning within the host country;
- To demonstrate the commitment of the government of the host country to safety and particularly to emergency preparedness.


*RanidSONNI mobile laboratory awaiting shipment at the IAEA Laboratories at Seibersdorf.*

# Sophisticated On-Site Nuclide Identification (RanidSONNI)

In 2008, Finland's Nuclear and Radiation Safety Authority (STUK) teamed up with Ukraine in a bilateral project aimed at constructing a mobile detection and monitoring laboratory for the State Nuclear Regulatory Committee in Ukraine (SNCRU). In the past, STUK had designed, developed and built their own radiation reconnaissance vehicle from scratch, as STUK had the primary responsibility to detect and respond to nuclear security incidents in Finland. STUK's home grown version had many features that would be considered for the vehicle being built for the Ukrainian experts, except for the alpha spectrometry capability and the additional placement and use of lanthanum bromide (LaBr3) detectors.

STUK had received funding to assist Ukraine in developing a response capability for nuclear security related incidents, i.e., incidents where nuclear and other radioactive material were out of regulatory control. As the project moved forward, Finland invited Sweden to join in the project. Sweden accepted and provided additional funding. Finland's and Sweden's added resources allowed to secure the equipment for a detection and monitoring vehicle of a class unto itself for Ukraine: a brand new and fully outfitted van worth half a million Euros that is built on the shell of a Mercedes Benz ambulance. Through the assistance of the IAEA's Office of Nuclear Security, the van has been shipped to the offices of the State Nuclear Regulatory Committee in Ukraine (SNCRU), which are located in Kiev.

This mobile laboratory named SONNI (Finnish for bull), is based on a design by STUK scientists aimed at detecting and responding to nuclear safety and nuclear security incidents. The front end of the van has two stainless steel tubular structures that look like horns protruding on either side of the windscreen not unlike the head of a bull. In reality, Mr. Petri Smolander and Dr. Harri Toivonen, the prime originators of the vehicle, coined for fun the acronym SONNI, bull, for "Sophisticated ON-site Nuclide Identification".

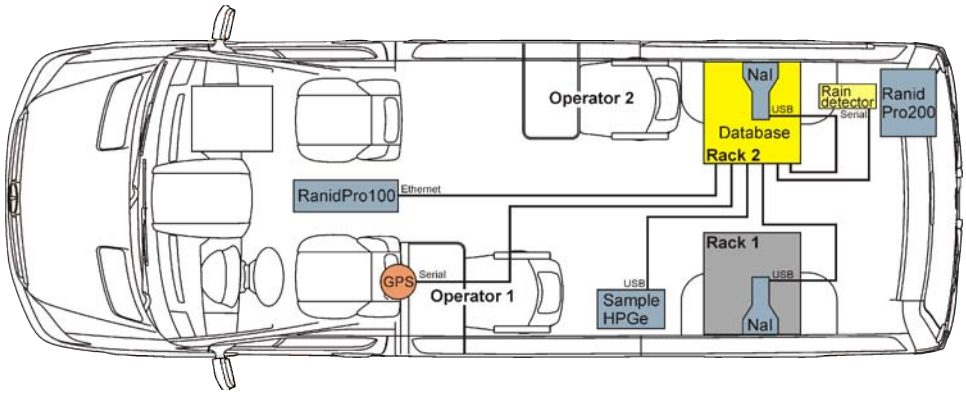
Owing to the nature of the project with Ukraine and because STUK is a governmental agency, STUK sold the manufacturing plans for the SONNI van to Environics, a

Finnish specialty company. Working in parallel, Environics built the van, while STUK built the van's detection and analysis systems.

Environics renamed the SONNI to RanidSONNI Radiation Reconnaissance Vehicle. This real eye-catcher of a van comes with state of the art equipment: three air sampling systems (two that are built-in and utilize stainless steel "horns" as intakes and one that is portable) and four gamma radiation detectors (consisting of a sodium iodide detector on either side of the van, a forward looking LaBr3 detector and one high purity germanium detector). These systems are connected through a central server to three analysis workstations. The workstations feature laptops that receive gamma spectra data and information from the on-board GPS, allowing for real time analysis anywhere in the country. Topping the cake, an additional subsystem in the form of the RanidPro200, built by Environics from the designs pur-chased from STUK, allows a portable system for gamma (LaBr3) and neutron (Li6) monitoring and includes a data transfer function within the van for a wide-ranging and speedy analytical capability.

The IAEA took delivery of the RanidSONNI van in April 2010. At a welcoming ceremony at the IAEA laboratories in Seibersdorf, experts from STUK and the IAEA introduced the special systems of the vehicle and shared insights on training. The van is now in Ukraine, has cleared Ukrainian customs and has been licensed by the motor vehicle authority. IAEA specialists and Finnish experts will soon work with their Ukrainian counterparts to integrate this standard setting, in-kind contribution by Finland into SNRCU's detection and response operations.

The RanidSONNI adds to Ukraine's abilities to strengthen safety, security and safeguards of nuclear materials, radioactive sources and other substances. In particular, the RanidSONNI will be a significant tool for Ukraine's Nuclear Security Strategy, as Ukraine continues to make preparations to co-host the 2012 UEFA Euro Cup with Poland. STUK and Environics will continue to support the IAEA and Ukraine during this transition process. Who knows, perhaps an upshot from this shared experience will be to observe other Bulls deployed the world over.




## A bull by any other name…

STUK's RanidSONNI mobile laboratory with its state-of-the-art, onboard computer and detection equipment has been delivered and is now ready for duty in its new Ukraine home.

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# Over land, sea and air: safe and secure transport of radioactive material

Decommissioning activities, international businesses dealing with the conditioning of radioactive waste and expanded applications of radioactive material (particularly in medicine) all involve the transport of significant quantities of radioactive material. States, therefore, need to expand their regulatory regime to cope with this reality. Historically, however, they may not have had the need to apply safety standards. Therefore, the promotion of a sustainable transport safety infrastructure is at the core of the programme of the Department of Nuclear Safety and Security.

The Convention on the Physical Protection of Nuclear Material (signed at Vienna and at New York on 3 March 1980) is the only international legally binding undertaking in the area of physical protection of nuclear material. It establishes measures aimed at preventing, detecting and punishing offenses relating to nuclear material. A Diplomatic Conference was convened in July 2005 to amend the Convention and strengthen its provisions. The Amendment to the Convention makes it legally binding for States Parties to protect nuclear facilities and material in peaceful domestic use, storage and transport.

## Questions and answers

*Q: What are the uses of radioactive material?*

A: Radioactive material is used in many fields, including health care, industrial process control, quality control of industrial products, power production and agriculture. Radioactive material can also be a key component in commonly used household objects.

## Health care applications

*Q: How is radioactive material applied in medical diagnosis?*

A: Diagnostic procedures rely on nuclear medicine in studying the functioning of internal tissues and organs. In these procedures, the patient is first given some radioactive material orally or by injection that is directed to a specific tissue or organ. With the aid of a camera that scans the radiation area and creates an image, a doctor can view on a computer monitor not merely the organ under examination, but also the way it functions. As a result, the doctor can draw conclusions about the patient's health – without the need for surgery and in a relatively short time.

Every day, medical workers perform more than 10 000 000 procedures per day worldwide. This number is increasing because diagnosis with nuclear medicine is more accurate, faster, painless and cost-effective than with more traditional means. Even children undergo nuclear medicine procedures, which are especially appropriate for detection of cancer or diagnostic examination of the heart, lungs, liver, kidney, thyroid, bone, intestines and brain.

*Q: Can you treat cancer with radioactive material?*

A: Large doses of radiation can kill cancer cells. For thyroid cancer, radioactive iodine, called iodine-131, is administered to the patient. For treatment of tumours, the radiation from a radioactive material called cobalt-60 is used. Over 45 000 treatments are carried out with cobalt-60 every day in more than 50 countries.

## Sterilization of medical products

*Q: For what other health care processes can radioactive material be used?*

A: Radiation is very effective for sterilization. Single use medical supplies, such as syringes, gloves, cotton and bandages are sterilized using radiation from cobalt-60. Most first-aid kits found in our homes are sterilized by radiation.

Radiation is also instrumental in other health care applications: irradiated blood, for instance, is used in life-saving blood transfusions, as it reduces the risk of immunological reaction in the recipient.

*Q: What about food: can radioactive material serve to preserve food?*

A: Enormous quantities of food grains, vegetables and spices are lost every year due to infestation. This waste can be stopped by treating food with radiation. Cobalt-60 is used for the purpose of preserving food.

## Industrial applications

*Q: How can radioactive material apply to process control?*

A: Industrial process control aims to prevent waste and the manufacture of defective products. In the beverage industry, process control relies on radiation detectors for controlling the filling level of soft drinks or beer in metallic cans. In this technique, the filled cans are passed between a source of radiation and a radiation detector: the filled portion of the container stops the radiation and the

unfilled portion allows all radiation through. The detector verifies the filling level. This device is called a level gauge
.
Process controls for verifying density, thickness and moisture rely on gauges that use radioactive material in their mechanisms: density gauges are used for determining the density of materials, for example, in the dredging of rivers and harbours; thickness gauges determine very precisely the thickness of metal sheets, plastic films, papers, etc.; moisture gauges are employed in oil exploration activities and the construction of roads. In each of these instances, radioactive material in the gauge interacts with other substances in a predictable manner that facilitates measurements.

*Q: Can radioactive material be used in industrial radiography?*

A: Defects in the welding and casting of metal objects are detected without damaging the objects by using a source of radiation. The principle is similar to the common diagnostic X ray examination. The radiation source is kept on one side of the object being tested and X ray films on the opposite side. A pressure vessel or an industrial boiler that has been tested by radiography is much safer than one that is not. Industrial radiography assures the quality of the product and often saves life and property.

## Power production

*Q: Can radioactive material be used to generate power?*

A: Radioactive material (uranium compound) is used as fuel in nuclear reactors to produce clean and cost-effective nuclear power, which provides lighting and heating to our homes and workplaces, illuminates the streets, runs the trains, moves the elevators and escalators and enables the functioning of communication systems.

## Consumer products

*Q:* Is radioactive material found in everyday work or household objects?

A: Millions of smoke detectors operate around the world, preventing fire accidents and saving lives and property. Smoke detectors use a small radiation source.

Dials painted with luminous radioactive compounds are in common use. The dials can be read in the dark. If a power failure occurs in a theatre hall and we have to rush out for safety how do we find the exit? The “Exit” sign would go off because of the power failure! Many “Exit” signs we see in public halls glow due to the radiation from the radioactive material inside the signs. They will glow even if there is a power failure.

Radioactive material is used in fluorescent lamps for improved efficiency.

## Other uses

*Q: How else can radioactive material be used?*

A: Radioactive material is used for determining the soil quality for agriculture and to study nutrient uptake by plants. Radioactive material is used for detecting the presence of an element and the quantities in which it is present in a given sample. These are but a few of the uses of radioactive material.

Not only hospitals and patients, but industrial establishments, agricultural scientists, manufacturers and users of the many industrial and consumer products, public utilities and communication organizations depend on radioactive material for satisfying day-to-day needs and providing services. Radioactive material is integral to the quality of life today.

*Q: Why transport radioactive material?*

A: Radioactive material is produced only in a few facilities in the world. From there this “silent worker” has to be carried to the user: a hospital, a factory, a power station or a home. Radioactive material may have a short useful life. It has to be rushed to the user by air.

The radiation sources used in nuclear medicine are transported in small quantities by air. If they are not used within a short period, they lose their radioactivity. Patients are given appointments by hospitals and clinics well in advance and the supply of the radioactive material is scheduled accordingly. If the radioactive material does not arrive on time, patients who may have travelled from far away might have to be turned back, losing precious time and the money spent in travelling and hotel accommodation. All that would be wasted. Most importantly, the diagnostic examination would be missed and the treatment that may be urgently warranted would be postponed.

Similarly, if a cobalt-60 source intended for a cancer therapy facility or a sterilization plant is not delivered on time, many patients will go without treatment and several tonnes of medical supplies or food products will miss radiation processing. A delay in the delivery of fresh fuel to a nuclear power plant will result in reduced production of power. The consequences of reduced power are too obvious to warrant listing.

Today, radioactive material fills a large number of needs for our daily well-being: its safe and efficient transport is essential.


*This year marks the 20th anniversary of INES, the International Nuclear and Radiological Event Scale jointly developed by IAEA Member States and the OECD Nuclear Energy Agency (OECD/NEA). Twentieth anniversary group picture of DDG Flory and the INES National Officers in Vienna, October 2010.*

# INES at 20: Success from simplicity

Since 1990, INES has been used for promptly and consistently communicating to the public the safety significance of events associated with the transport and storage of radioactive material and the use of radiation sources.

Currently, 69 countries are Members of INES. Several Member States have organized national training workshops on INES, thus enhancing the use of the Scale in its areas of application. These steps have led to the consolidation of INES as the worldwide scale for putting in a proper perspective the safety significance of nuclear and radiation safety events.

The success of INES is due to its simplicity and solid technical basis: it is easy to understand and use. Yet, reaching agreement on the scale involved compromises by Member States and a commitment to apply the scale in a consistent way. IAEA General Conference resolutions GC(52)/RES/9 and GC(53)/RES/10 welcomed the 2008 edition of the manual and urged Member States "to designate INES national officers and utilize the scale" and "recognized the efforts of the Secretariat and Member States in implementing INES". The most recent INES User's Manual, the 2008 edition, was aimed at better addressing areas and activities such as the transport of radioactive material or human exposure to sources of radiation. In 2009, the IAEA organized for the first time a Train-the-trainers Workshop on INES. Since then, eight Member States joined the INES system: Algeria, Indonesia, Kenya, Latvia, Malaysia, Serbia, Thailand and Zimbabwe.

At the opening ceremony of the 20th anniversary of INES during the Biennial Technical Meeting of the INES National Officers in Vienna (11–15 October 2010), DDG Denis Flory observed: "The 20th anniversary of INES is an occasion to celebrate its success in fostering transparency and providing a better understanding of nuclear related events and activities worldwide." The meeting was an opportunity to highlight the successful implementation of INES and discuss how to further enhance the use of INES as the worldwide scale for communicating nuclear and radiological events. The celebration brought together over 60 experts, including the first Chair of INES, Prof. Richard Taylor, INES national officers and public information officers.

# IAEA and Ibero-American Forum – strengthening ties

The Ibero-American Forum of Nuclear and Radiation Safety Regulatory Agencies (the FORO) was created in 1997 to promote a high level of safety in all practices using radioactive and/or nuclear material in Member States, and particularly in the countries of the Ibero-American Region (Art. II of the FORO's Statute). The FORO currently comprises the regulatory bodies of eight countries: Argentina, Brazil, Chile, Cuba, Mexico, Peru, Spain and Uruguay. The technical programme of FORO rests on an IAEA Extrabudgetary Programme (EBP) that is funded by voluntary contributions of FORO Member States. This EBP started in 2003: its first technical project created a platform for exchanging knowledge, good regulatory practices and lessons learned.

Thanks to the availability of funds under the EBP, the FORO launched a number of projects ranging from accident prevention in the medical uses of radiation to collaborative approaches between regulatory and health authorities, licensing the life extension of nuclear power plants and control of inadvertent radioactive material in the scrap metal and recycling industries. As the outcomes of these projects became known to other countries in the region, the dissemination of this information and the application of lessons learned gained in priority: this information is now being circulated and applied through IAEA Technical Cooperation activities. The IAEA and its Safety Standards are the scientific reference in FORO's activities: FORO's proactive approach in promoting a high level of safety is significantly contributing to extending the reach of the IAEA Safety Standards in the region.

In late 2009, the FORO and the IAEA decided to consolidate their relationship. On 22 September 2010, this was achieved: the current President of the FORO and DDG-NS signed a formal arrangement to confirm their relationship.

*DDG D. Flory and L. Hormazábal, President of the Ibero-American Forum of Nuclear Safety Regulatory Agencies (FORO), following signature of the agreement of cooperation.*

# Highlights of the 54th IAEA General Conference, 20–24 Sept. 2010

| | |
|---|---|
| Side event on 21 Sept.: Interview with DDG D. Flory | DDG D. Flory met the press and spoke of the challenges facing the IAEA in nuclear safety today. “Bridging the gap between old and new generations of nuclear power plants is an issue, and we need to address this new reality,” he said. Story: http://www.iaea.org/NewsCenter/News/2010/safenewold.html . |
| Visits to the Incident and Emergency Centre on 21–22 Sept. | During the General Conference, close to 50 conference participants had the opportunity to visit the IAEA’s Incident and Emergency Centre, the IAEA’s focal point for responding to nuclear or radiological incidents and emergencies. The visits presented the activities, infrastructure and communication procedures of the Centre. About the IEC: http://oasis.iaea.org/oasis/oasis/iec/about_iec/ |
| Side event on 22 Sept.: Current NSRW Activities in Decommissioning and Remediation | On behalf of Ms. E. Amaral, Director, NSRW, Mr. M. Vesterlind presented the current activities of NSRW in decommissioning and remediation as a side event to the General Conference. The presentation touched, inter alia, on Naturally Occurring Radioactive Material and radioactive legacies, the Iraq Decommissioning Programme and the Use of Safety Assessment Results in the Planning and Implementation of Decommissioning. Presentation: http://www.iaea.org/OurWork/ST/NE/NEFW/documents/Magnus%20Vesterlind%20-%20GC54%20-%20Amaral%20Networks%20Side%20Event1.pdf . |
| Side event on 24 Sept.: the Regulatory Cooperation Forum | Through the recently-launched Regulatory Cooperation Forum, the IAEA supports nuclear newcomer countries in their efforts to launch safe, secure and sustainable nuclear power programmes. The all-day event covering the Regulatory Cooperation Forum was well attended: some 90 experts from 40 countries attended. Canada, Iran and Pakistan formally requested to participate in the forum’s plenary meetings. Story: http://www.iaea.org/NewsCenter /News/2010/nuclregulation.html . |
| Interview with K. Mrabit | In a related interview, K. Mrabit, Head, NS-SSCS, described the advantages of bringing together nuclear power veterans and newcomers to share regulatory information: “The two communities are aware that nuclear safety and nuclear security are global issues requiring global collaboration and coordination”, he said. Interview: http://www.iaea.org/NewsCenter/Multimedia/Videos/GC54/240910/Mrabit/index.html |

# International conference “Challenges faced by TSOs” highlights

Between 25 and 29 October 2010, some 270 participants joined leaders, experts and panellists from nuclear regulatory authorities and Technical Service Organizations (TSOs) from 57 countries in Tokyo, Japan, to discuss the challenges faced by TSOs in enhancing nuclear safety and security. This conference, hosted by Japan, was a follow-up to the first international conference dealing with this subject held in 2007 in Aix en Provence, France. The Tokyo conference convened at a time when the number of countries considering expanding their use of nuclear energy and those countries considering embarking on nuclear power programmes has increased. As providers of competence, expertise and research, TSOs will play an increasingly important role in helping countries to develop adequate nuclear safety and security infrastructure and in supporting regulatory bodies with scientific and technical advice. The conference programme considered four aspects: Topical Issue one dealt with the roles, functions and values that guide TSOs; Topical Issue two addressed technical and scientific support for nuclear safety infrastructure development and capacity building; Topical Issue three focused on the emerging need for nuclear security technical and scientific support and Topical Issue four covered nuclear safety and nuclear security networking and centres of excellence. Further information on the conference can be found on
http://wwwpub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=38092

*TSOs discussing challenges in nuclear safety and security*

# Department programme highlights

## News

### Norway underpins 2.5 mil. euro extrabudgetary programme

***September 2010 –*** On 23 September 2010, DDG-NS, Denis Flory and Norwegian Ambassador J. Petersen signed an agreement for a new, three-year Extrabudgetary Programme (EBP) aimed at developing and implementing competency building features in safety assessment within the Global Nuclear Safety Assessment Network (GSAN). This new EBP will enhance independent, technically justified, safety decision making capacity in IAEA Member States embarking on nuclear energy programmes. Through the use of the GSAN framework, the EBP will: (a) assist countries developing nuclear power programmes in nuclear safety needs assessment; (b) support Member States in safety assessment capacity building and knowledge management; and (c) enhance the sharing among Member States of safety assessment knowledge and experience. In a side event to the General Conference, experts and the Heads of the regulatory authorities of Bulgaria and Romania reported on the one-year milestone of two extrabudgetary programmes on Safe Nuclear Energy funded by the Norwegian government. Senior NSNI officers and their Bulgarian, Norwegian and Romanian counterparts briefed meeting participants on the programme concepts, objectives and implementation methods covering the nuclear power plants of Cernavoda in Romania and Kozloduy in Bulgaria. Story:
http://www.iaea.org/NewsCenter/News/2010/safene.html

### Online seminar system inaugurated through the Safety Assessment Network (SAN)

***October 2010 –*** The test run by NSNI/SAS of “Webinar”, the new online seminar system, was highly successful: participants in the Republic of Korea, Pakistan and Croatia were able to communicate freely with each other and IAEA Headquarters. The system will allow the IAEA safety assessment team to conduct online training and meetings to include all Member States that wish to participate, while eliminating the need to travel to workshops and courses. With audio and video connections, a moderator can make Powerpoint presentations, show videos or other materials to a large group of online attendees who can all hear, see and hold discussions with each other by

way of this electronic platform. Practical trials will be held involving lecturers at IAEA Headquarters and trainees in Pakistan.

# Upcoming events

## Regional conference on Safe Nuclear Energy Initiatives, Brasov, Romania

***29 March to 1 April 2011–*** At the conclusion of two Norwegian-funded IAEA EBPs for Safe Nuclear Energy: Regional Excellence Programmes Bulgaria and Romania, programme promoters, partners, and participating experts will present results of a model programme framework applicable to other IAEA Member States. European Member States are encouraged to attend. Contact: Mike Modro, Acting Head, Safety Assessment Section, NSNI – m.modro@iaea.org.

## Bulgaria-Romania Joint Emergency Preparedness and Response Exercise on the Danube River, Bulgaria.

***April 2011 –*** With the culmination of training and experience gained through EPR projects of the Extrabudgetary Safe Nuclear Energy Programmes for both Bulgaria and Romania, a joint exercise will be held in April on the Danube River to challenge EPR teams and assess preparedness and response to a transport-related emergency.

# Networks

## Preparing for the launch of the Global Safety Assessment Online Network

***July 2010 –*** Safety assessment competence is key to making the right decisions in design, licensing and operation of nuclear power plants. From 29 – 30 July, an advisory group of TSOs, regulators and emerging nuclear power programme countries met at the IAEA in Vienna to lay the groundwork for the Global Safety Assessment Network (GSAN), an Internet network linked to other IAEA platforms for project collaboration, information sharing, education and training. GSAN can be tailored to specific Member State needs and is aimed at countries embarking on nuclear power programmes and those with mature nuclear power programmes. GSAN is designed to foster (i) support in safety assessment to developing Member States, (ii) sharing of safety assessment knowledge and experience and (iii) collaboration among Member States on validation and improvement of safety assessment methods.

# Impressum

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