

EUROSAFE TRIBUNE

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MORE NUCLEAR IMPLIES INCREASED SAFETY

Review of the main themes discussed
at the EUROSAFE Forum
held in Brussels in November 2009

CONTENTS

WELCOME AND ADDRESSES 4

Three major safety implications of a growing demand for nuclear energy

PRESENTATIONS 6

Enhancing safety tomorrow: a 360° overview

PANEL DISCUSSION 8

Thoughts for the future

JSP 12

JSP activities aimed at improving collaborations

SEMINARS 14

Seminar 1

Nuclear installation safety assessment
A broadening scope of subjects 14

Seminar 2

Nuclear installation safety research
Supporting assessments...
today and tomorrow 16

Seminar 3

Waste management & environment
Dealing with a bulky legacy 18

Seminar 4

Nuclear material & facilities security
Towards more holistic
approaches of nuclear security 20

Seminar 5

Radiation protection
Innovative approaches
and techniques 22

WORKSHOP 24

Exchange of views on safety
needs in developing nuclear power

The papers referred to in the seminar section
are available at www.eurosafe-forum.org



Jacques Repussard (IRSN) and Heinz Liemersdorf (GRS).

According to the IAEA, 70 countries which do not operate any nuclear facility to date have announced their interest in nuclear power generation. On its side, the *Nuclear Energy Outlook* published by the OECD NEA sees an increase from the current 440 reactors in operation to about 600 units by 2050, and even 1,400 units in the case where governments give credit to the contribution of nuclear to the reduction of CO₂ emissions and where other alternatives such as renewables or CO₂ sequestration prove unsuccessful. Figures may vary on a large scale, but embarking on nuclear power remains in any case a long-term commitment, requiring notably a well-established technical and regulatory infrastructure.

In this respect, there is a danger for those countries that already operate nuclear plants of underestimating the need for a proportionate effort to develop competencies, capabilities and safety infrastructure. For 'newcomers', the danger is rather that they might be inclined to move too fast and not make the necessary effort to establish the technical and legal framework to ensure, for instance, that unbiased safety assessment relies upon ownership and independence of judgement.

To debate on the safety implications of an increased demand for nuclear energy, the EUROSAFE Forum 2009 in Brussels invited panellists from international organisations, regulatory authorities, TSOs, utilities, research centres, etc. coming from countries which operate nuclear power plants and, for the first time, from countries in the process of including this power generation means into their energy mix. From the difficulties in establishing a technical and legal infrastructure nationally through to the importance of research, training, international collaboration and the needed support from TSOs, the challenges of safe nuclear power were addressed and passionately discussed.

We are pleased to invite you to making your own judgement on these issues and we wish you pleasant reading. ●

Jacques Repussard and Heinz Liemersdorf

WELCOME AND ADDRESSES

Three major safety implications of a growing demand for nuclear energy



Hosted by Bel V, the Belgian TSO, the EUROS SAFE Forum 2009 took place in Brussels under the aegis of Bel V, GRS and IRSN. As explained by Bel V's General Manager Benoît De Boeck, the goal of this Forum was to help answer a major question at a time where the demand for nuclear energy is expected to increase with new plants in existing nuclear countries and new entrants across the globe: What does this increasing demand imply in terms of the availability of nuclear safety expertise?

First implication: The development of safety assessment guides by TSOs

An activity that was started some years ago under the EUROS SAFE umbrella, the development of safety assessment guides aims to help the safety assessors when they are reviewing the safety demonstrations established by licensees. "These guides are, of course, not the safety guides being developed by the IAEA. Their goal is to harmonise the way safety assessments are conducted in various countries. They are also a knowledge manage-

ment tool in the sense that they embody the experience accumulated in the past by the people who have performed safety assessments," Benoît De Boeck explained.

Second implication: The development of powerful knowledge management

"It is an illusion," IRSN's Director General Jacques Repussard stressed, "to think that technical and scientific knowledge could be stored successfully in regulations and guides. This is why there has been very wide use in Europe

of the concept of the technical safety organisations tasked not only with carrying out the safety assessments on behalf of the nuclear safety authorities but also with looking after the technical and scientific knowledge.”

A job in itself, knowledge management requires many efforts, starting with research. “The safety authorities and the TSOs must be able to assess, in the light of the latest knowledge, what is being proposed to the benefit of safety and radiation protection,” Jacques Repussard went on. “This is why the TSOs in Europe are widely engaged in research and play a significant role for example in the Sustainable Nuclear Energy Technology Platform (SNETP), leading the thinking on the objectives for nuclear safety for the next generation reactors, for instance.” But knowledge management is also about sharing existing knowledge and making sure its understanding and use are harmonised: this is the objective of EUROSAFE. Finally, dealing with knowledge is also about the capability of the TSOs to organise knowledge maintenance and transfer, training, education and active support in the development of infrastructure in countries that operate nuclear installations. “In this regard, the ETSON members, together with other institutes and organisations, are planning to launch very shortly the European Institute for Training and Tutoring in Nuclear Safety, which will offer training and tutoring programmes for young, newly recruited technical staff in TSOs and safety authorities worldwide,” he concluded.

Third implication: The set-up of a platform to exchange operating experience feedback

“Operating experience is at the heart of the development of the safety of nuclear installations,” GRS’ Technical and Scientific Director Lothar Hahn

emphasised, “and licensees as well as regulators are interested in maintaining adequate OEF systems. The European Commission volunteered to set up such a system for its member states and it was obvious that the European TSOs had to support the Joint Research Centre of the EC with their great knowledge and competence in nuclear reactor events analysis. IRSN and GRS agreed to put in a joint offer and the support of other ETSON members is already being planned. This tender is the first economic cooperation within the framework of ETSON and I hope that it is just the beginning of long and successful teamwork.” ●



GRS’ Technical and Scientific Director Lothar Hahn (retired) on stage.

ETSON: toward increased visibility

Upon welcoming the participants to the EUROSAFE Forum 2009, Benoît De Boeck recalled the role played by ETSON in the following terms: “ETSON is composed of European technical safety organisations supporting their national safety authority with a global regulatory vision, working in a continuous way and with a broad scope. The membership of ETSON is therefore a subset of the membership of the EUROSAFE Programme Committee. Since the end of last year, the five members of ETSON have been Bel V, GRS, IRSN, UJV and VTT. More members will join the club and it is the vision of ETSON to become more visible in Europe and worldwide and be more active in promoting and developing European scientific and technical cooperation between the TSOs in the field of nuclear safety. To that end, ETSON is moving from an informal club to a more formal association, and this will strengthen the links between the members and help the network become more effective.”

PRESENTATIONS

Enhancing safety tomorrow: a 360° overview



Reflecting the respective considerations of international organisations, regulatory authorities, TSOs, utilities and the European Commission, the eight presentations held at the EUROSAFE Forum 2009 provided the audience with an insight into the major safety challenges associated with the development of nuclear energy and the state of thinking in this area. Key ideas are proposed below, the corresponding addresses are accessible on www.eurosafe-forum.org > EUROSAFE Forum 2009 > Panel lectures.

Comply with the safety standards from the very beginning of any nuclear programme

In his address titled *The Perspective of the IAEA*, Philippe Jamet, the Director for Nuclear Installations Safety at the IAEA, pointed out: “70 countries that have no installations announced to the

IAEA in some way that they are interested in nuclear power. When we see all 70 countries that are interested in nuclear power – the newcomers – the IAEA’s objective is that if these countries go for nuclear power, they should implement and comply with the safety standards as soon as they start their new nuclear power plant. That is what we have as our fundamental objective.”

Second International Conference on challenges faced by the TSOs in enhancing nuclear safety and security

Announced by Yoshihiro Nakagome, the Vice President of the Japan Nuclear Energy Safety Organisation, this event is to be hosted by JNES in Tokyo from October 25 to 29, 2010, under the aegis of the Japanese Nuclear and Industrial Safety Agency and the IAEA. It will follow up the first TSO conference held in Aix-en-Provence (France) in 2007 and discuss the TSOs’ contribution to the global nuclear safety and security regime.

Beware of lessening the regulatory constraints

As the Chairperson of the State Nuclear Regulatory Committee of Ukraine, Mrs. Olena Mykolaichuk reminded the audience of the Chernobyl accident on 26 April 1986 and questioned the work

performed over the following years to enhance nuclear safety. “Unfortunately,” she said, “during the last two years, we have often heard some things about lessening the regulatory burden and limiting safety assessment to countries of origin of new nuclear designs and sometimes even about regulatory outsourcing. We, as the regulatory community, need to do everything possible to prevent our governments, politicians and the nuclear industry from starting to think that severe accidents will never happen again and that they can take it easy and lessen regulatory burdens.”

1,400 reactors by 2050?

Referring to the *Nuclear Energy Outlook* issued by the OECD’s Nuclear Energy Agency in October 2008, Javier Reig, Head of the Nuclear Safety Division at the NEA, highlighted the factors which led the NEA to think that there was a need to renew nuclear energy. “Will we therefore reach 1,400 reactors in 2050?” Mr. Reig asked, commenting on the different scenarios of growth, before shifting to the second part of his address devoted to the Multinational Design Evaluation Programme set up by the NEA together with the regulatory authorities from 10 countries.

There is no future without the past

After a description of GDF SUEZ’ safety policy, built up drawing upon decades of operating experience, Paul Rorive, the Group’s Corporate Director for nuclear activities, addressed the situation of newcomers on the nuclear arena, asking: “Is it therefore possible for them to have a future when they have no past? We in Europe have beaten our path ourselves, but it is not possible to say to the new countries that they should just wait 45 years and then they will have a nuclear power plant, because they also need energy and the energy challenge is greater in those countries than it is in Western Europe. We therefore have to take this into account and it is a really difficult challenge.”

Updating one’s own regulations while contributing to international harmonisation

“Embarking on nuclear power is a long-term commitment, requiring an effective regulatory infrastructure,” stresses Lasse Reiman, a Director of STUK, the radiation and nuclear safety authority of Finland. “In this respect, we think that it is important for us in Finland to update our own regulations while contributing at the same time to international harmonisation. At the European level, we are really looking forward to further activities of WENRA, when it starts to discuss requirements for new designs.”

Making nuclear safety standards binding commitments

“37 new reactors have been announced or planned in 12 EU member states,” Head of European Directorate for Nuclear Energy Peter Faross recalls, “in this context, the role of the European Union is to develop, in the interests of all member states, the most advanced legal framework for nuclear energy, ensuring the highest standards of safety, security and non-proliferation. With the Nuclear Safety Directive, the EU became the first regional nuclear actor to give binding legal force to the main international nuclear safety standards, namely the safety fundamentals established by the IAEA and the obligations resulting from the Convention on Nuclear Safety.”

Networking: the response to an increased demand in safety expertise

As the acting President of ETSO, Benoit De Boeck concluded the different presentations by stressing the advantages of networking to take up simultaneous safety challenges with limited time and resources, referring to initiatives such as the Junior Staff Programme (JSP), ETSO and the European Nuclear Safety Training and Tutoring Institute (ENSTTI). ●



Javier Reig, Head of the Nuclear Safety Division, OECD-NEA.

PANEL DISCUSSION

Thoughts for the future



What are the safety implications of an increased demand for nuclear energy? Gathering six panellists from international organisations, TSOs, research centres, the industry and the press, the panel discussion moderated by the French journalist Marie-Dominique Montel aimed to provide balanced views on the key issues associated with the new build projects in several countries as well as the long-term safety of nuclear facilities in operation.

The panellists

Michel Debes
International Relations
Delegate,
Nuclear Generation, EDF

Philippe Jamet
Director, Nuclear
Installations Safety, IAEA

Gustaf Löwenhielm
Director, Research
Department, SSM

Ann MacLachlan
European Bureau Chief,
Platts Nuclear Publications

Rauno Rintamaa
Vice President,
Business Solutions, VTT

Eric van Walle
General Manager, SCK-CEN

Is there an increasing demand for nuclear energy?

As a journalist specialising in nuclear energy, Ann MacLachlan opened the debate with the following consideration: “I would say that there is an increasing interest in nuclear energy. What are the signs of this? There have been many more commercial conferences recently, many more positive articles, and more aggressive anti-nuclear groups. However, there are also signs of cracks in the general consensus, as the new plants cost more than previously expected, raising doubts about the economic viability. Also, in many places, the money has disappeared owing to the economic crisis, and fossil fuel prices are down. Therefore, many of the nuclear programmes that were on the charts have been delayed or are on the verge of being cancelled.” Sharing Mrs.

MacLachlan’s caution, Gustaf Löwenhielm declared: “There is a bottleneck in terms of the infrastructure, and we should be careful in assuming figures such as 1,400 reactors by 2050. I doubt that this will come true.”

Major challenges associated with the upsurge of nuclear programmes

Shifting from an increasing interest in nuclear energy to an increasing demand implies several safety challenges to be tackled, Philippe Jamet stressed: “I would like to concentrate on two of the main safety challenges. The first one is the danger that a newcomer will move too fast and not make the effort to develop its own infrastructure. The second is regarding countries that have never stopped constructing, and this is the danger of going too fast in terms of investment without a pro-

portionate effort to develop competencies, capabilities and safety infrastructure.” Reflecting an operator’s view, Michel Debes commented: “Regarding new build, our main objective is to develop nuclear power through reliance on proven design and to reap the full benefit of standardised options based on experience feedback and advanced design.” Eric van Walle provided a nuclear research centre’s perspective on the impact of nuclear commitment on research by pointing out: “Governments do not always provide the necessary financial input or expertise in order to create research centres, so we need to look at putting in place new types of mechanisms to support research so as to guarantee the safety assets they are interested in.”

Education and training: a key issue to ensure the safety of existing and future plants

Highlighted by Philippe Jamet, the risk of insufficient development of competencies and capabilities inspired Eric van Walle’s following statement: “More than 30 years ago, the universities had developed extensive programmes that guaranteed education in the nuclear area, and the government supported them. But there were two major nuclear accidents in the 1980s and the awareness of the nuclear waste issue. University programmes vanished and government research supports disappeared in every country, and both research and training were in a perilous situation.” In this respect, Gustaf Löwenhielm remarked: “The challenge today is to expand education in the nuclear area, not just to maintain it. Looking at Sweden, we decided in conjunction with the industry to support professors and assistant professors, where previously we had only supported PhDs. You could say that this was a life raft to maintain education in this area, and it really paid off.” Clearly, such support requires the

involvement of different players – government, industry, etc. – in each country, but this is not enough, VTT’s Vice President Rauno Rintamaa claimed: “A number of new fora such as ETSON have been established in Europe. There is also a specific working group within the Sustainable Nuclear Energy Technology Platform on training and knowledge management. There should be very clear links between these different European organisations, because we cannot afford to have many of these pan-European groups.” Evidently, time has come for international cooperation in education and training, just as in safety research or expertise. Concluding this chapter of the debate, Michel Debes underlined the importance of on-the-job training besides education with these words: “You can have courses, workshops, etc., that will give you some background, but they will never teach you how to apply regulatory approaches, to apply real safety assessments and monitor the construction of a plant. Therefore, it is good to have academic training, but you must also have very vigorous on-the-job training.”

Standardisation or harmonisation?

Reflecting the expectations of society, Ann MacLachlan observed: “If the number of reactors increases globally, the safety level of each reactor individually should also increase in order to reduce the probability of a severe accident. However, standards must and will change more quickly than they have in the past. We see even now that regulatory authorities are rewriting the standards on which they based new reactors that are not even finished. Society will continue to demand even greater safety levels, and it will be almost impossible to have a stable, standardised regulatory regime for 25 years.” In this respect, Rauno Rintamaa recalled that standardisation must not mean stagnation: “We must continue to research and to improve the



Michel Debes, International Relations Delegate, Nuclear Generation, EDF.



Philippe Jamet, Director, Nuclear Installations Safety, IAEA.

plants, so that the modern plants are better than the ones built in the 1970s. We have already started identifying some technical methods which could be harmonised across the 37 organisations covering all the nuclear stakeholders.” Philippe Jamet on his side stressed the need for a standardisation roadmap which shares safety analyses, licensing conditions and validation with some ownership on the part of regulatory bodies: “We need to come up with some guidelines on how licensing conditions can be defined for newcomers so that regulatory bodies can enjoy full sovereignty in licensing”, he said. “From an IAEA point of view, the more standardisation and harmonisation the better. However, the problem of standardisation would be solved quite easily if it were a mere technical issue, but it is not. The problem is that a nuclear power plant is also a political matter, and this is the real barrier. Countries want to preserve their political independence and their safety responsibilities, and this is the most difficult issue.” Giving an insight into the industry’s perspective, Michel Debes explained: “Standardisation does not mean that all the plants will be the same, but rather that they will be based on the same global architecture and common specifications sufficient to

define equipment procurement for the nuclear islands. There is room, of course, for items which are site or country dependent. But standardised units have the potential to yield major benefits for safety, cost-effectiveness, and efficiency. Standardisation could facilitate investment by allowing predictable licensing conditions.” Recognising the importance of the efforts made by the industry toward standardisation and harmonisation, Eric van Walle underlined: “They might facilitate access to new countries that want to build power plants. However, this also raises a question, as those countries need to set up regulatory bodies and establish experience before they can assess what is going on. One could say that industry will help in that regard, but this may result in a kind of industrial colonisation in some countries unless they have the time to educate their people.”

The new face of public and stakeholder opinion

Describing how the Internet revolution impacts public access to information and, subsequently, the behaviour of the nuclear community in this domain, Ann MacLachlan recalled: “In the 1950s, people got their information from newspapers, in the 1960s they got it from television, now it is the Internet. There has been a quantum leap in the number of sources both journalists and the public can access. Regarding the nuclear safety issue, the nuclear industry, TSOs and safety organisations should themselves use the Internet much more than they do today, and put out the documents and the raw information as quickly as possible, so that people may begin to have more confidence in the competence, honesty and transparency of these institutions.” Warning against the potentially negative effect of too much information made available, Rauno Rintamaa advocated: “We have to provide the right information. Concerning the credibility and trustworthi-

Hans Steinhauer, Managing Director of GRS in charge of commercial and legal affairs (left), talks with Jacques Repussard, Director General of IRSN.



«I have been very glad to participate as the guest lecturer to this EUROS SAFE Forum, as it gave me the opportunity to compare the safety challenges and approaches in astronautics and nuclear. In the aerospace industry, it is usually not possible to achieve safety and reliability using redundancies; therefore, design principles are based on best practices and proven technology to take minimum risk. To me, the

astronautic and nuclear sectors have several common denominators such as the necessary compliance with very strict safety rules from design stage, the requirement to make parts that perfectly fit the existing systems – may it be a space shuttle or a nuclear reactor – available over several decades, the technical complexity and very high costs of programmes that are often carried out in international cooperation,

requiring appropriate interfacing to be ensured. Other common points are the necessity to keep vigilant, to observe strict discipline where there is no room for complacency, to capture the knowledge and know-how from retiring generations and, last but not least, the ability to assess the overall safety of the system, as 100% of the equipment do not operate perfectly. »



Dirk Frimout

First Belgian astronaut
Guest lecturer at the
EUROS SAFE Forum 2009.

ness of the information, opinion polls helped determine the most reliable source of information concerning the safety of nuclear power with TSOs and R&D organisations ranking first along with regulators, the second in line being the power companies and Greenpeace coming near the bottom. These results show people can recognise the importance and relevance of information. We thus need to create factually based and well documented information and to distribute it to all key stakeholders. And we must provide information in a very simple form so that people can understand it in the correct way.” As a conclusion to the panel discussion, Philippe Jamet declared: “We should always think, when we are communicating with the public, that we might have to explain tomorrow that something very serious happened. Accepting that there is a risk represents the highest level of public acceptance. I think public acceptance needs to be given time. Maybe there are industrial solutions now, but research is ongoing, and people will always have to learn things. So we have to keep the road open in order to optimise the concepts we are now developing, and research is of great value in that regard.” ●



Journalist Marie-Dominique Montel (middle) moderates the panel discussion bringing together speakers such as Gustaf Löwenhielm Director of the Research Department at SSM and Ann MacLachlan, European Bureau Chief of Platts Nuclear Publications.

JSP

JSP activities aimed at improving collaborations



As more TSOs recently joined the ETSON network, the number of young engineers joining the Junior Staff Programme is expected to grow. In order to simplify the first contacts with their international colleagues, and thus give future JSP projects momentum, the current JSP members consider the creation of a new JSP website a priority. A second major initiative in progress is the preparation of the third ETSON/JSP Summer School due to take place next August in the Bavarian town of Garching, near Munich.

The creation of the new JSP website: a necessary impetus to current and future JSP projects

“There are presently about a dozen JSP engineers from Bel V, GRS and IRSN, but the circle is enlarging with new organisations such as UJV and VTT, the Czech and Finnish TSOs respectively, joining the ETSON network. We are looking forward to welcoming the young engineers from UJV and VTT to the JSP and to cooperate with them on our current and future activities,” Bel V’s Sarah Vandekendelaere points out.

The experience feedback from previous JSP pilot projects shows how challenging the management of projects

is among people who do not really know each other. All JSP members see the creation of a new JSP website as a necessary tool to simplify the first contacts and to coordinate and monitor the progress of future JSP Pilot Projects. *“If we want to motivate our colleagues from other TSOs to participate in common projects, we need to get to know each other well enough, to get acquainted with each other’s scope of work and experience,”* UJV’s Vaclav Hakl advocates. In this regard, the JSP website will provide different functions such as a detailed profile of each JSP member, a forum, topical mailing lists, an electronic mail service, etc.

“When launching new projects, a real face-to-face meeting is irreplaceable,” admits Lars Niederhausen from GRS, “but once you know each other, the follow-up through audio or video conferencing is easy.”

The next step is to detect possible collaborations by identifying the fields the young engineers of the ETSO members are working in and what their skills and experiences in those fields are. *“Once we have a clear view of what projects each JSP member has been working on, or would like to work on in the future, we can encourage the contact with their peers by, for example, launching threads in the forum that are related to these projects so that a discussion is started that may one day lead to a JSP Pilot Project,”* Sarah Vandekendelaere concludes.

Preparation of the ETSO/JSP Summer School 2010

Building upon the success of the Summer Schools organised in Garching (near Munich) in 2008 and in Cadarache (near Marseille) in 2009, the JSP is actively preparing the next session due to take place again in Garching, from August 23 to 27, 2010. *“We have a very positive feedback from the previous Summer Schools [see box]. Participants were really enthusiastic, as these five days are the opportunity to not only share knowledge and methodologies during the presentations, but to really get to know each other during the Working Groups,”* IRSN’s Karim Ben Ouahrem stresses. *“We are now in the process of identifying the potential ‘hot’ topics to plan the programme for the 2010 Summer School and we expect a large number of young engineers from the new ETSO members to participate.”* ●

Flashback on the second ETSO/JSP Summer School

Organised by IRSN at Cadarache from July 6 to 10, 2009, the second edition of the Summer School gathered 35 participants from the ETSO members Bel V (Belgium), GRS (Germany), IRSN (France) and UJV (Czech Republic) as well as from NNL (UK) and from the Czech regulator SUJB.

The programme was focused on *Methodologies and Technical Aspects in Nuclear Safety Assessment*. The first day featured a common session with rather general presentations about the safety guidelines, safety analysis reports and experience feedback analysis. The other days were filled with more detailed presentations, with two simultaneous topical sessions on Thursday: one on waste management, transport and decommissioning, and one on the safety of different generations of reactors (GEN III, GEN IV and ITER) including an example of a successful international project on severe accidents (SARNET).

11 working groups allowed the participants to share methodologies on a specific technical topic (aircraft crash, fire, event analysis, transport waste management...) and to prepare joint presentations of their results. Last but not least, technical visits rounded off the programme: GALAXIE (fire experiments), CABRI (reactivity injection tests) and the site of the future ITER (International Thermonuclear Experimental Reactor) project.

...SCHOOL SUCCESS!
 LOGIES AND TECHNICAL ASPECTS
 ", CADARACHE, JULY 6-10, 2009
 ENDELEARE (BELV), Z. KRIZ (NRI-UJV), A. WOKRAL (NNL)
 Nuclear Safety Assessment" took place from July 6th
 ants from 5 technical safety organisations (IRSN France,
 tech nuclear authority (SUJB) joined the Summer School
 cs covered nuclear power reactors and other nuclear
 ns. The program was divided in 2 parts:
 mon session with the presentation of ETSO, EUROSAFE,
 Staff Program, the safety guidelines, the experience
 ck analysis and the external/internal hazards.
 opical sessions in parallel: one on waste management,
 ort and decommissioning and one on the safety of different
 tions of reactors (GEN III, GEN IV and ITER) including
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 ents (SARNET).
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JSP member Karim Ben Ouahrem (IRSN) presents the poster introducing the successful ETSO/JSP Summer School 2009.

SEMINAR 1 | Nuclear installation safety assessment

A broadening scope of subjects



In the context of a revival of nuclear power generation, TSOs have to cover a broadening scope of subjects associated notably with the development and implementation of technologies. Nuclear safety thus requires an increasingly comprehensive view on issues, leading TSOs to develop, on the one hand, capabilities to perform safety analyses at the design stage of systems – such as new programmable electronic devices – in order to understand the safety implications of their complexity and, on the other hand, to go further downstream through on-site inspections aimed at verifying that safety prescriptions are properly implemented during the construction phase of new plants.

■ From events to recommendations

How does the analysis of an operating event at a reactor translate into recommendations aimed to improve safety? Taking the example of the Forsmark-1 event of 25 July 2006, the first lecture of this 2009 seminar described the work carried out by Bel V, the Belgian TSO, to review the analyses of this event performed by various TSOs and to issue short-term and long-term recommendations aimed to improve the design of electrical systems from a safety point of view. The debate following the presentation highlighted the need for follow-up work to check how the different operators took these recommendations into consideration.

■ From “hardwired logic” to programmable electronics: new assessment methods for a new technology

As part of their quest for increased performance of nuclear plants, operators update their control systems using newly developed technology, e.g. programmable electronic components such as FPGA (Field Programmable Gate Array). They allow the designer to program complex functions into one chip, using languages and tools similar to those used for software. Experience feedback from avionics and space domains shows that FPGA programmes are subject to design errors in the same way as software. Due to the potentially huge number of execution cases, FPGA pro-

grammes cannot be qualified by 100% testing or other post-design approaches, thus the ability to be verified must drive the whole development process. TSOs therefore need to implement a new approach intended at assessing how they are technically specified, designed and verified. To do so, IRSN has initiated a project devoted to this particular type of analysis, in cooperation with the industry and research laboratories. This ongoing work notably helps standardisation committees, as an IRSN expert coordinates the development of a new IEC standard to address this topic.

■ From internal to external hazards: the extended use of PSAs

Originally performed as a complement to the deterministic approach to assess internal events likely to impact reactor safety, probabilistic safety assessments (PSAs) are commonly used also to analyse external hazards linked among others to the climate change, e.g. storms, heat waves, etc. Such analyses provide very useful information not only for improving the overall risk assessment of existing reactors but also for selecting notably an acceptable site for a future plant. The NEA is reviewing the PSAs currently performed in different countries on external hazards with a view to consolidating the lessons learnt.

■ From requirements to implementation: the benefits from a Safety Concept

What are technical and safety requirements worth if they are not implemented appropriately throughout the different stages of the nuclear plant's life cycle? This is the kind of question a Safety Concept intends to respond to by combining the requirements to be considered and the processes required for ensuring that these requirements will be met at

each stage of the plant's life. The authors explain that the process part of the Safety Concept is strongly governed by the licensing environment which, in turn, explains why a definite and universal Safety Concept for the licensing approaches in the different countries is not achievable.

■ From safety case analyses to on-site inspections: enhancing the final safety level

TSOs increasingly consider that their task cannot be restricted to assessing safety 'on paper', upstream of the construction phase of a new plant, but also 'on site', through inspections of the construction works. This is what STUK, the Finnish safety authority, is doing on the EPR under construction at Olkiluoto (Finland) and IRSN on the EPR construction site in Flamanville (France). Taking this latter example, the authors point out that such on-site inspections carried out jointly with ASN, the French nuclear regulator, resulted in remarks on e.g. the quality of the concrete used, the basemat pouring or the liner welding that contribute to enhancing the final safety of the plant. ●

→ The text of the contributions presented at this seminar is available online at:

www.eurosafe-forum.org → EUROSAFE Forum 2009 → Seminar 1



Benoît De Boeck

*General Manager
Bel V.*

« I was struck by different things I heard during the EUROSAFE Forum. First of all, it seems possible again to attract and recruit young people, as they don't have any longer this negative preconception of nuclear as an energy belonging to the past.

The second thing is that realism has taken the lead, since nobody would pretend any more nuclear is absolutely safe and any possible problem has been solved with the latest generation of reactors. To me, this realistic approach is a prerequisite to credibility. Thirdly, the awareness of the need to pool resources beyond national borders to improve safety – and the inclination to do so – is increasingly noticeable among TSOs, regulators, research centres, etc., at a time where nuclear plant manufacturers are pushing for aligned licensing procedures across the world. The creation of ETSON bears witness to this dynamic of best practice sharing. »

SEMINAR 2 | Nuclear installation safety research

Supporting assessments... today and tomorrow



Nuclear safety research contributes to the build-up of skills and tools used to perform the eventual assessment work. This statement takes a particular importance for TSOs as new build projects bloom across the globe as a response to an energy demand constantly on the rise. According to commonly quoted figures, about 250 additional units are planned, of which 30 are under construction. In this context, the safety research conducted by TSOs spans over three generations of reactors, from units that have been in operation for three decades to concepts supposed to become operational from 2040 onwards... A multifaceted challenge, as explained by the different lecturers.

■ Reducing the safety gap between two generations of reactors

The planned extension of the lifetime of existing (generation II) reactors and the simultaneous construction of new generation III units raise two types of questions that current R&D activities are aiming to answer. The first one being related to the ageing of reactor components and subsystems, utilities are leading a research network called NULIFE to assess how the ageing phenomena impact the overall safety of NPPs, as explained in the lecture titled *The European NULIFE research network for plant life manage-*

ment. The second issue TSOs are faced with is the coexistence of two reactor generations: generation II, for which lifetime extension is presently under consideration, and generation III, in the design of which the risk of radioactive releases in the event of a severe accident was included with a view to minimising this risk by design. Operators have started to install catalytic recombiners in generation II reactors, for instance, thereby contributing to reduce the safety gap between these two generations. On their side, TSOs have initiated proactive research aimed to

encourage operators to go further by showing them the feasibility of different technical solutions.

■ Harmonising safety research...and assessment approaches

The resumption of nuclear programmes is a global trend and vendors are designing products for sale throughout the world. In their contribution titled *Collaboration on fire code benchmark activities around the international fire research programme PRISME*, the authors show how the convergence of scientific and technical approaches advocated by international networks and associations like ETSON or WENRA translates more and more systematically into research programmes conducted in international cooperation, optimising in this way the use of available resources, the alignment of working methods and the sharing of results.

■ Honing the comprehension of physical phenomena through advanced simulation

As evidenced in the paper titled *International test programme in the THAI facility and its use for code validation*, TSOs are working more and more in partnership to develop, test and validate computer codes intended to represent the complex physical phenomena occurring in a reactor with an increased realism. Such advanced tools are required to assess the safety cases prepared by the operators relying upon ever more sophisticated safety demonstration methods.

■ Controlling the risks associated with higher burnups and new fuel designs

As the energy source in the reactor, fuel is a 'core' issue for nuclear safety, particularly as regards its coolability and the release of fission products into the coolant in the event of an accident. The current trend towards

higher burnup rates combined with the development of new fuel pellet, rod or cladding designs results in new safety problems, calling for further research aimed at reducing uncertainties and updating the existing safety criteria. The contribution titled *Fuel behaviour under LOCA and RIA, and its implication on the current safety criteria* provides an outlook on the results obtained so far in two areas: loss of coolant accidents and reactivity initiated accidents.

■ Setting safety objectives to future designs

The paper titled *Advanced neutron transport methods for the analysis of LWR and innovative reactor concepts* illustrates a particular research domain initiated with a view to gaining knowledge needed eventually to set safety objectives to future designs such as generation IV reactors. This generation of fast reactors, expected to enable significant fresh fuel savings, is scheduled to replace the generation III reactors no earlier than 2040, but safety research needs to be started now if TSOs intend to be ready to perform assessments in due time. ●

→ The text of the contributions presented at this seminar is available online at:

www.eurosafe-forum.org → EUROSAFE Forum 2009 → Seminar 2



Yoshihiro Nakagome

Vice President
Japan Nuclear Energy
Safety Organization (JNES).

« As a member of the IAEA's Advisory Group on Nuclear Security (AdSec) representing Japan, I am seeking synergy between safety and security. And in this respect, Japan is in a very particular situation. If safety is unanimously recognised as paramount when developing nuclear energy – and I think this is something everybody, from operating engineers to the top management, is fully aware of in Japanese companies involved in the development of nuclear power –, the awareness of security issues in Japan is very low. Thus, there is only one single word – 'anzen' – in Japanese to express the concepts of 'safety' and 'security'. I guess this is due to the specific culture and social context in the country. Nevertheless, as Japan exports its nuclear technology, the government placed emphasis on the '3 S' concept which compounds 'safety', 'security' and 'safeguards'. Security aspects are very important indeed, since we all live in a world where threats exist, and JNES, the Japanese TSO, is seriously tackling this issue. »

SEMINAR 3 | Waste management & environment

Dealing with a bulky legacy



Reflecting a growing concern of governments confronted with the need for a sustainable storage solution for long-lived, high-level waste, papers devoted to geological disposal represented most of the lectures at this 2009 Waste Management & Environment seminar. The different contributions highlighted notably the relentless effort to experiment waste containment techniques, the increasingly perceptible EC support to the development of performance assessment methodologies and the need for further development of modelling tools pertaining to e.g. releases or sensitivity analyses.

■ Experiments to get a better understanding of thermal, hydraulic and chemical phenomena in deep repositories

An accurate assessment of the containment capability of sealing systems requires a deep understanding of the thermal, hydraulic and chemical (TH&C) processes that combine in underground repositories with a view to gauging the adequacy of thermal-hydro-mechanical codes such as MELODIE, designed to simulate the transfer of radioactive elements resulting from the waste package degradation over time scales expressed in thousands of years. Presented at this 2009 seminar, the paper titled *Sealing experiments at the Tournemire Underground Research Laboratory* explains

how the findings of such experiments help prepare technical assessments as a support to decisions at government level scheduled for 2015.

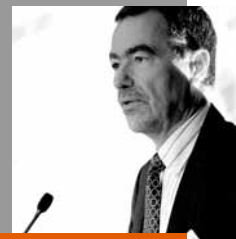
■ A benchmark of the current approaches to repository safety research

A major EC-supported project involving 27 organisations from 10 European countries (as well as non-European organisations such as the US DOE), PAMINA is aimed among other things at peer reviewing the different methods outlined internationally for the safety analysis of geological repositories. As explained in the two lectures respectively titled *The European perspective on performance assessment methodologies: The inte-*

◀ **Compared with 40 years ago where each country more or less had its own reactor designer and power utility**, we are now operating in an open and deregulated environment. This translates into several challenges, starting with the licensing of new technology in several countries whose safety regulations and requirements are not aligned. Another challenge is to address at the same

time issues such as technology, partnerships, human resources, communication, R&D, etc., to restart the industrial manufacturing of reactors. On their side, regulators are faced with similar constraints when licensing new plants. Thirdly, whereas financing extremely capital-intensive projects such as new reactors requires long-term visibility on markets, public opinions change quickly

along with the news, and situations regarding public and political acceptance of new nuclear programmes in different countries are rather dissimilar. This complexity is quite a problem for 'traditional' nuclear countries, but it is all the more for new entrants who will need our support to successfully take up such a huge challenge. ▶▶



Paul Rorive

Senior Vice President
Nuclear Activities Division
GDF SUEZ.

grated EU project PAMINA and A benchmark on sensitivity analyses tools applied to analytical test models, the most significant outcome of the project is in fact the consistency of approaches adopted in the participating countries, in spite of some variations in the terminology used in each of them. This coherence is partly due to the general compliance with the recommendations issued by the IAEA and the OECD-NEA, pertaining notably to the preparation of post-closure safety cases. The PAMINA project also provides insights into some issues such as the uncertainties pertaining for instance to sensitivity analyses, which require further development. Its results are going to be used to support another project performed by the NEA's Integration Group for the Safety Cases (IGSC) under the name of Methods on Safety Assessment.

■ **Assessment of environmental issues associated with radioactive waste: broadening the scope**

Financed by the German Federal Ministry of Economics and Technology (BMWi), the project pertaining to the *Modelling of release and transport of toxic substances in a high-level radioactive waste repository in clay formations* addresses the environmental

impact of toxic substances other than radionuclides, e.g. heavy metals used for waste containers. Organisations such as Andra, the French waste management agency, are performing similar studies in their respective countries, but the German project did not only deal with the scientific aspects of the subject but also with legal questions, with a view to assessing whether the present legal framework is adapted and, if not, what kind of legal adaptations would be required. ●

→ **The text of the contributions presented at this seminar is available online at:**

www.eurosafe-forum.org → EUROSAFE Forum 2009 → Seminar 3

SEMINAR 4 | Nuclear material & facilities security

Towards more holistic approaches of nuclear security



As evidenced by the different lectures given at the 2009 seminar, the initiatives taken (usually in an international framework) to improve security in the nuclear sector reflect an increasingly wide-ranging approach of issues where, for instance, processes are considered together with materials, and soft skills together with technical skills.

■ A broader scope for the security control of the industry

By the mid-90s, it appeared that the verification of commitments made by the member countries of the non-proliferation treaty could not be restricted to the control of nuclear materials. Therefore, an Additional Protocol to the treaty was drafted with the aim to detect prohibited actions by controlling immaterial activities. As explained in the paper titled *French experience in the implementation of the "Additional Protocol"*, industrial corporations subsequently have to declare the control processes they implement, in addition to the materials they use. Thus comparing in the different signatory countries the declarations provided

by the industry on one hand with those issued by the government administration on the other hand helps evidence the conduct of potential underground activities. The Additional Protocol is getting signed by an increasing number of major countries such as the USA.

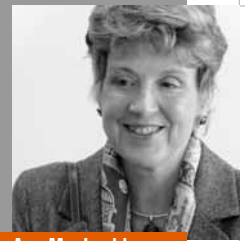
■ Helping the IAEA improve the behavioural skills of its inspectors

Tasked with verifying the application of the non-proliferation treaty as regards in particular the prevention of nuclear material trafficking for malevolent purposes, the IAEA's Department of Safeguards relies upon the support of signatory countries to improve its efficiency. The Agency thus expresses its needs, and participating countries

« I wanted the audience at this EUROSAFE Forum to be aware of the constraints journalists are under, notably the pressure of time and the need to be “the first” with the news. Whereas nuclear matters are very complex subjects, nobody in the general press has the time to do research. In this age of Internet-based information, if the very first ‘raw’ information a journalist

gets is misunderstood, an erroneous report can become “the truth” because it is circulated immediately around the world. I don’t know if the industry understands this, because unfortunately they don’t always respond the way they should – they are also under pressure from stock markets. There is currently a tension between the nuclear industry – which wants to

harmonise and standardise to go faster and, they say, to build and operate safer reactors – and the nuclear safety community which is concerned that things are going too fast and experience feedback may get lost. This is even more a challenge when talking about new countries, where they have to do everything all at once, and just as well, as it took us forty years to do. »



Ann MacLachlan

European Bureau Chief
Platts Nuclear Publications
Publisher of Nucleonics
Week.

finance such initiatives as the development of e.g. a new detector. In this context, France proposed to identify the needs related to the training of IAEA inspectors, as the detection of undeclared activities during inspections requires certain behavioural abilities besides scientific and technical skills. The paper titled *Inspectors’ behavioural competencies evaluation for recruitment and training development* describes how IRSN designed evaluation questionnaires usable for the recruitment and training of inspectors for the IAEA’s Department of Safeguards.

■ A new facility to test structure resistance against detonating charges

Assaults using explosives is one of the malevolent actions addressed as part of the work carried out to protect nuclear facilities against terrorism. Due to the lack of uninhabited areas in a country like France and to the cost of large-scale experiments, the conduct of tests with sizeable detonating charges to verify the resistance of structures is a problem. These are the reasons why an experimental set-up has been developed in the Paris metropolitan area to perform reduced-scale tests, the authors explain in their contribution titled *Laboratory scale tests for the assessment of solid explosive blast effects*. The results of these reduced-scale experiments are used to produce the

entry data for computerised assessments of the structure resistance. Publicising the existence of such an experimental set-up draws the attention of the nuclear security community on the availability of testing facilities they could use, and makes the public at large aware of the fact that the protection of nuclear facilities is properly addressed by the countries.

■ Security of nuclear weapons to be disposed of in Russia: a successful Russian-German cooperation

In its contribution titled *Physical protection of nuclear material and of nuclear weapons to be disposed of in the Russian Federation*, Russian General Evgeny Maslin presented the achievements of a (€ 75 million) Russian-German cooperation programme aimed to improve the security of nuclear arsenals in the Federation as part of the Global Partnership Programme. One should note Germany was the first country free of nuclear weapons to assist the Russian Ministry of Defence in modernising the physical protection of its nuclear arsenals pending elimination. ●

→ The text of the contributions presented at this seminar is available online at:

www.eurosafe-forum.org → EUROSAFE Forum 2009 → Seminar 4

SEMINAR 5 | Radiation protection

Innovative approaches and techniques



Focused on the results from new approaches for monitoring radiological exposure, cleaning contaminated facilities or predicting the development of radiological burns, the 2009 seminar on Radiation Protection included notably presentations by lecturers from several countries such as the Czech Republic, bearing witness to the EUROSAFE Forum's endeavour to let the audience benefit from a broad international experience and best practices.

■ Measurement of radiological exposure: advantages and shortcomings of the new electronic personal dosimeters

As explained in the presentation titled *Current problems in the field of radiation protection technique – Use of Active Personal Dosimeters (APD) in pulsed radiation fields*, active research is devoted to the development of a new dosimeter technology capable of providing real-time information for monitoring and controlling radiological exposure responsively both in the nuclear industry and in the medical sector. This paper concludes that the electronic personal dosimeters give satisfactory results for the measurement of continuous radiation emis-

sions (e.g. in nuclear power plants or waste management facilities) but require further developments in the pulsed radiation fields (e.g. in medical applications).

■ Decontamination of nuclear facilities and equipment: the benefits from a new chemical process

During nuclear plant outages, decontamination is performed to lower the radiological exposure of staff tasked with maintenance work and fuel reloading or reshuffling. Besides the existing high-pressure water and mechanical techniques, a new chemical method is introduced in the paper titled *Chemical decontamination in nuclear systems – radiation*

« To measure public acceptance, the EC organises Eurobarometer surveys on a regular basis in the EU's 27 Member States. The results show that the two overriding issues are nuclear safety and the safe management of nuclear waste, non-proliferation being a concern to a lesser extent. On the first issue, the Member States' support for regulating safety allowed the EU going one step forward with the unan-

imous adoption, on 25 June 2009, of a new directive providing for the continuous improvement of nuclear safety. The same directive requires regulators to be independent and equipped with appropriate human and financial resources to carry out their job. Concerning nuclear waste management, it appears as the main argument for citizens who oppose nuclear energy. However, six out of ten

opposing nuclear would change their position, if a sustainable solution were operational. Therefore, a common legislation on nuclear waste management obviously has to be launched by the Commission. Regarding non-proliferation, the EC is closely cooperating with the IAEA, but I regard further advances on an international level as a necessity to ensure long-term stability. »



Peter Faross

*Head of Directorate H Nuclear Energy
Directorate-General for Energy and Transport
European Commission.*

protection issues during planning and realisation. Based on the use of a chemical agent which forms mostly oxidation or reduction reactions with the contaminated surface, this new method allows turning the radionuclides into different chemical substances that are readily removable from the surface and separable (e.g. by ion exchange) from the decontamination solution.

■ **Predict the development of radiological burns to guide surgeon's hand**

Among other international support activities, TSOs happen to help countries with limited skills in the establishment of diagnostics, the reconstitution of doses and the provision of medical care, in case one of their nationals suffers from a radiological burn. In a paper titled *Contribution of IRSN to the international RP assistance: dose reconstruction after an emergency exposure*, the authors recall the necessity to predict the burn's development in order to adopt the right curative strategy. As this varies greatly with the dose, its reconstruction is crucial and requires advanced methods capable of guiding the surgeon's hand by predicting accurately what part of the patient's body will be impacted and how.

■ **Anticipate the radiological consequences of a terrorist attack**

Assessing the possible radiological consequences of malevolence associated with the release of radioactive substances requires mathematical and physical models to simulate the attack under "realistic" conditions. This concern prompted such organisations as the National Radiation Protection Institute (SURO) of the Czech Republic to develop computer simulation tools and perform experiments in which radioactive substances were dispersed over a free area with the use of an industrial explosive. As explained in the contribution titled *Results of several field tests simulating a radiological emergency situation in case of misuse of radioactive materials during a terrorist attack*, the data obtained were used for a model inter-comparison exercise organised as part of the IAEA's Environmental Modelling for Radiation Safety (EMRAS) II project. ●

→ **The text of the contributions presented at this seminar is available online at:**

www.eurosafe-forum.org → EUROSAFE Forum 2009 → Seminar 5

WORKSHOP

Exchange of views on safety needs in developing nuclear power



Are new entrants and countries that resume nuclear programmes faced with similar or different challenges? Where are the common denominators between them regarding safety issues? To provide some answers, the EUROSAFE Tribune met EUROSAFE Forum participants from four countries as well as the IAEA's Director of the Division of Nuclear Installation Safety. Ashok Thadani, former head of the US NRC's Office of Nuclear Regulatory Research, moderated the exchange of views. The interviewees, as evidenced below, reflected a broad recognition of the complexity of the technology, the required long-term commitment for entering into a nuclear power programme, commitment to the IAEA standards, responsibilities of safety authorities including independence and transparency, difficulties in establishing national infrastructure in the near term (about a decade), importance of educational institutions, research and training, needed support from TSOs and importance of engaging in international collaboration.

Safety is paramount and sufficient time must be devoted to it

P. Jamet (IAEA): "For new entrants and countries that have a very rapid and ambitious construction programme alike, making sure that they are developing their nuclear safety knowledge, infrastructure, capabilities, etc. is the real challenge. They might feel inclined to go too fast."

J. Sharaf (Jordan): "We are saying politically that we need to get the nuclear energy as soon as possible, but when you consider it from a safety point of view, it takes 15 years or more in order to be sure

that we have our national safety plan. From my point of view, there is no possible shortcut in regulatory issues."

The establishment of a legal framework is a priority

J. Sharaf (Jordan): "Two laws were passed to initiate the nuclear programme. One was to establish the Atomic Energy Commission and to start the nuclear programme. The other one was to establish the Jordan Nuclear Regulatory Commission (JNRC). At JNRC, the first step we are focusing on is the set-up of

the regulatory framework.”

A. Renieri (Italy): “The Italian Government decided on a roadmap for the first new nuclear plant to become operational in 10 to 15 years. Therefore, the new nuclear act brought in in August reorganises all the agencies involved in nuclear-related activities. The Department for nuclear power, industrial and technological risk of the Institute for Environmental Protection and Research (ISPRA) and about 50 professionals from the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) will constitute the Agency for Nuclear Safety. The Agency will act as a national authority for the technical regulation, control and authorisation aimed at the security, management and transfer of radioactive waste and nuclear materials, at the protection from radiation, and at the supervision of the construction and safeguarding of nuclear plants and materials.”

Capacity building is key to ensure ownership of nuclear safety

P. Jamet (IAEA): “For the new entrants, there is quite a significant capacity building effort to make to just get ownership from the operating point of view and also from the safety point of view. I do not think it would be reasonable for all countries to have a complete TSO with the full scope capability. But they should be able to specify what they want, understand the accuracy as well as the completeness of assessments, and then have ownership of the result. For the IAEA, this means meeting a huge need for help in capacity building through e.g. training, workshops, networks, promotion of internships...”

J. Sharaf (Jordan): “The most important is to find the appropriate human resources and to make sure that a suitable education and training will be available for them. Recently, we recruited about 40 new staff members and are working on qualifying them in accordance to a plan that we are implementing in coordination with our international partners. In

doing so we can ensure that nuclear safety can be in good shape in Jordan.”

P. Storey (UK): “Up to about three years ago, we were seriously understaffed, and over the last two years we have successfully recruited about 50 people. Considering that we had 160 to 170 inspectors, that is quite an achievement. In parallel, we have set up a technical support framework. At the end of the tendering process, we selected 31 contractors across 15 technical areas. Thus, when a potential licensee or vendor makes a safety submission to us, we have adequate sources of high quality independent technical capability to assist us in our assessments.”

E. Uspuras (Lithuania): “The Lithuanian technical support organisation (LEI) was created some 15 years ago and recruited quite young engineers. Now we have about 50 people in nuclear installation safety and about 30 people in the nuclear engineering department. We have established a regular training centre, together with the IAEA. We train people not only from Lithuania but also from other countries. Also we help our regulator, VATESI, develop skills. There is a nuclear course in the Kaunas and Vilnius universities of technology. Today, we consider building a new nuclear power plant and a dedicated university programme, with the support of our government.”

A. Renieri (Italy): “As a large number of our people will have retired in the near-term, the next five years are crucial for improving the situation. We are ready to improve our expertise and to train new people and we are trying to make the best use of our experimental facilities, since research is very important for education and training related to expertise activities. The situation is improving, because engineers and scientists know that it is possible to find an attractive job in the nuclear sector.”

External support is a leverage to make efficient use of internal resources

J. Sharaf (Jordan): “We are presently working towards building a safety cul-

The interviewees

Dr. Philippe Jamet
Director of the Division of Nuclear Installations Safety, International Atomic Energy Agency (IAEA)

Dr. Alberto Renieri
Adviser of the Commissioner, Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)

Dr. Jamal Sharaf
Director General / Chairman of the Board of Directors, Jordan Nuclear Regulatory Commission (JNRC)

Dr. Peter Storey
Head of Research, Nuclear Safety Directorate, Health and Safety Executive (HSE)

Dr. Eugenijus Uspuras
Director of the Lithuanian Energy Institute (LEI)



Alberto Renieri (ENEA).



Eric van Walle

Director General
Belgian Nuclear Research
Centre (SCK-CEN).

«Among the prerequisites to the decision of developing nuclear power in the coming years, I think research, education and training are central issues. This implies investing further to give young engineers projects where they can innovate and offer them state-of-the-art education and training to do so. The industry provides highly specialised training courses to support its expansion and exports, but I don't think this is sufficient, since a nuclear power programme requires a holistic view on issues ranging from new design through to dismantling and waste management. Therefore, I think universities have to re-invest in education courses – such as Masters in nuclear engineering – to give future engineers this broad view. This is a way to alleviate the competition between the different players in the nuclear community for attracting and retaining a skilled and talented workforce, as the need to manage new power plants will overlap with the need to manage the existing ones.»

ture among our workers. In this regard, learning from countries that have long experience in the nuclear field is essential. We see that we can get strong support from international bodies right from the beginning, e.g. through peer reviews, from the set-up of regulations through to approval of siting, design and of course, later on, construction and operation of facilities, to overcome any shortage in financial support or lack of experience that we may face.”

P. Storey (UK): “It would be a waste of resources for us to repeat assessments performed by other regulators and major TSOs from other countries unless it is to provide a higher level of reassurance or confirmation. Therefore, it is important to have dialogues with regulators and share information wherever it is possible to do so. This is where the international research that goes on through the NEA and Europe has been key to our benefiting from developments in certain countries and participating in programmes aimed at producing high-quality experimental data, in developing codes and in developing and sharing good practice, etc. which we can use to do our own assessments.”

E. Uspuras (Lithuania): “Lithuania is a member of the European Union, and we have good support from Western countries. We also joined ETSON, and I understand we will develop faster together because there are great opportunities to discuss new projects, bottlenecks in human resources in every country and how we could cooperate to cope with this. For example, the Czech Republic – also an ETSON member – is probably going to build five new nuclear power plants together with Slovakia. They may need our help and we could really work together in a very efficient way.”

The benefits from international cooperation

P. Jamet (IAEA): “I see the IAEA's role as setting safety standards which represent an international consensus on the principles, requirements and recommended

ways to achieve a high level of safety. The IAEA also organises advisory and peer review missions focused on the application of these standards. To promote experience sharing and cooperation, we are also pushing regional networking as well as networking by specialties.

J. Sharaf (Jordan): “The IAEA has been offering us its full support through consultation and technical projects. The EU is helping us through a very important project that offers support in all aspects we need. We are also signing a number of MOUs or agreements with the CNSC in Canada, the US NRC and there will be full cooperation in the near future.”

P. Storey (UK): “One of the key issues with us over the last few years has been keeping up-to-date with what was happening in the rest of the world at a time when our own developments were slowing down. International projects have been a perfect way of achieving that, because the number of large scale experimental facilities has decreased and there is a lot of research underway which no single country could afford on its own.”

E. Uspuras (Lithuania): “We, as a TSO, have some experienced people who participate in international projects. We have contracts with the Swedish regulatory body; our regulator VATESI is part of WENRA and receives support from regulators in e.g. the United States, France or Germany.”

A. Renieri (Italy): “We joined the AIEA's International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) and we are members of the OECD's Nuclear Energy Agency. Two years ago we joined the GENEP programme; now we are involved in Generation IV through EURATOM. We need to increase our support for these international activities in order to enhance our capacity to work in Italy, to have absolutely independent judgment.” ●

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**The corresponding debates and seminars
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E U R O S A F E

*Towards Convergence of
Technical Nuclear Safety Practices in Europe*