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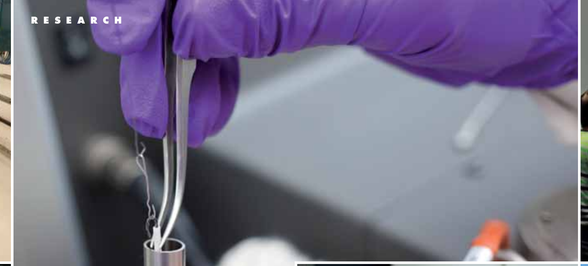

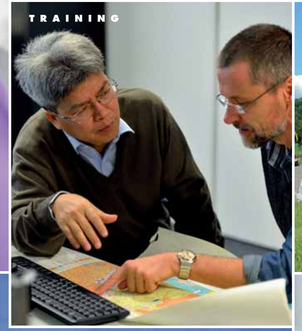

COMING NEXT...

International cooperation in a post-Fukushima era

27

Recalling the major challenges TSOs are faced with in enhancing nuclear safety in the post-Fukushima era, this issue will highlight central aspects such as capability enhancement, emergency preparedness and response, networking, cooperation... Drawing upon the views expressed by TSOs, governmental representatives and other stakeholders, conclusions and suggestions will round off this issue.

More on: www.eurosafe-forum.org

The EUROSAFE Tribune

EUROSAFE
Towards Convergence of Technical Nuclear Safety Practices in Europe

ETSON | IAEA

October 2014

EUROSAFE TRIBUNE

Towards Convergence of Technical Nuclear Safety Practices in Europe

26

BECOMING A CAPABLE TSO: AN ETSON VIEW

Born to take up nuclear SAFETY CHALLENGES

Delivering high-level expertise

Thriving ETSON

A contribution to the IAEA TSO Conference 2014 hosted by the government of China

Credits

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ETSON in the world

Founding members

1 **Belgium – Bel V**
Since 2006
Non-profit nuclear expertise institute for nuclear safety and radiation protection.
- 80 employees

2 **France – IRSN**
Since 2006
Public institute providing research and expertise in nuclear safety and radiation protection (human and environmental).
- 1 800 employees

3 **Germany – GRS**
Since 2006
Non-profit and independent research and expert organisation in the field of nuclear safety.
- 450 employees

Members

4 **Bulgaria – INRNE**
Since 2013
Leading Bulgarian Institute for nuclear physics and nuclear energy, radiochemistry, radioactive wastes treatment, monitoring of the environment, nuclear instruments development.
- 350 employees

5 **Czech Republic – RC Řež**
Since 2008
Engineering and scientific research private company dedicated to nuclear technology in various domains and focused on sustainable energy.
- 900 employees

6 **Finland – VTT**
Since 2008
Independent institution conducting research on safety, waste management, etc.
- 2900 employees including 200 people in nuclear activities

7 **Lithuania – LEI**
Since 2009
Expertise and research organisation in engineering, nuclear safety, hydrology, metrology, environmental protection.
- 300 employees

8 **Slovakia – VUJE**
Since 2010
Research institute on nuclear facilities in Slovakia.
- 800 employees with 200 people involved in TSO activities

9 **Slovenia – JSI**
Since 2013
Leading Slovenian scientific research institute, covering a broad spectrum of basic and applied research.
- 930 employees with 60 persons in nuclear activities

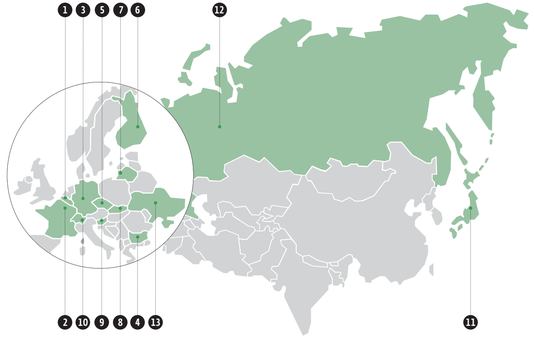
10 **Switzerland – PSI**
Since 2012
Largest research centre for natural and engineering sciences within Switzerland.
- Currently 1800 employees, of which 250 work in the areas of nuclear safety, waste management and radiation protection

Associated members

11 **Japan – NRA Secretariat**
Since 2014
Regulatory organisation
- 1000 employees

12 **Russia - SEC NRS**
Since 2012
Scientific and technical support organisation on nuclear and radiation safety regulation.
- 350 employees

13 **Ukraine – SSTC NRS**
Since 2010
State scientific and technical organisation supporting nuclear and radiation safety regulation.
- 253 employees



On the occasion of the IAEA International Conference on "Challenges faced by TSOs in enhancing nuclear safety and security" organised in cooperation with ETSON and hosted by the Government of China,

You are cordially invited to the Welcome Reception offered by ETSON on
Monday, October 27th 2014
From 6 to 8 pm
Juheyuan restaurant of the Beijing Friendship Hotel

ETSON | IAEA

To our readers

Although decisions about the use of nuclear energy are made at the national level, safety is a shared interest between countries, in particular as the consequences of potential severe accidents may cross borders. Taking stock of this reality, the latest revision of the nuclear safety directive adopted by the Council of the European Union goes a step further towards harmonising safety approaches and practices. It recognises the importance of technical considerations in nuclear safety and lays down common bases for shared technical approaches to nuclear safety. Furthermore, it acknowledges the role of technical support in regulating safety and the importance of safety assessment. This institutional recognition of Technical Safety Organisations (TSOs) at the EU level paves the way for EU action to ensure improved access to TSO assessment capabilities and for a stronger presence of ETSON in European work related to nuclear safety, including in regulator bodies such as ENSREG and WENRA.

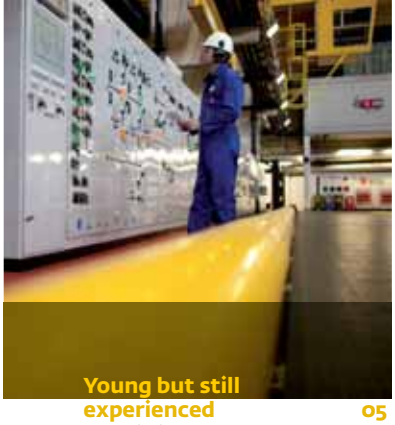
At the national level, it is up to each European TSO to consider its current and future scopes of activities – which may be quite different from one TSO to another – with a view to tackling the issue of harmonised approaches among TSOs. ETSON stands ready to help them implement their respective missions in a consistent manner.

ETSON aims above all to provide harmonised guidance, in particular by means of safety assessment guides, supplemented by the growing number of technical annexes that are increasingly acknowledged by the nuclear safety community. The Network also aims to support the common endeavour of research platforms which share objectives, methods and resources, particularly in the severe accident area, where many unknown factors remain. Another purpose of ETSON is to disseminate knowledge and operating experience feedback via the European Nuclear Safety Training and Tutoring Institute and to promote jointly developed tools, such as computer codes. Very importantly, ETSON is also here to help its member TSOs prepare joint responses to the EC's calls for tenders as part of *Horizon 2020*. The growing number of responses is a clear sign of the TSOs' ability to jointly elaborate technically and economically competitive proposals and to overcome the lack of institutional funding devoted to collaboration.

One track to explore in the future might be to develop ETSON into an established advisory group to the European Union and EU Member States, comparable to WENRA at the regulator level. This might be a relevant way to support countries to take up the challenge of enhancing nuclear safety, security and radiation protection.

We are glad to share these views with you and wish you pleasant reading.

Frank-Peter Weiss and Jacques Repussard



● I think regulators need a strong technical base in order to make correct decisions. Thus, it is extremely important to make sure that they all have robust TSOs available to support the regulatory programmes. ●

Brian Sheron, Director, Office of Nuclear Regulatory Research, US NRC

page 13

The EUROSAFE Tribune 26

The EUROSAFE Tribune is a periodical from the EUROSAFE Forum *published jointly by GRS and IRSN as a contribution to the EUROSAFE approach.*

Writers
Jean-Christophe Hédouin (HIME)
Cheryl Hutchison (Composys International)

Design and production
Martin Brunner Associés, Vivian Scheithe (GRS)

Iconographer
Charlotte Heuzé

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October 2014

Front cover picture:
Experts from an ETSON member TSO reviewing a safety case.

Contents

Kaleidoscope

ETSON NEWS

• New processes

With a view to running the call for tenders included in the NUGENIA+ project on Gen. 2 and 3 reactors, ETSON member TSOs led the development of a tendering process that is fully compliant with EC rules, in particular as regards the absence of conflicts of interest.

• Renewed cooperation

Following the reorganisation of nuclear safety in Japan, cooperation continues with the Nuclear Regulation Authority (NRA), as decided by ETSON's General Assembly on 9-10 July 2014 in Cadarache (France).

• IRRS Mission

ETSON associate member SEC NRS, the Russian regulator's TSO, actively participated in the Integrated Regulatory Review Service (IRRS) follow-up mission to the Russian Federation conducted under the aegis of the IAEA starting in November 2013. The report from this mission, which confirmed the effectiveness of the nuclear regulatory system in Russia, is available at: en.gosnadzor.ru > International cooperation.

TSO Conference

27-31 October 2014

Challenges Faced by TSOs in Enhancing Nuclear Safety and Security: Strengthening Cooperation and Improving Capabilities. Hosted in Beijing by the government of China, this international conference is being organised in cooperation with ETSON. The Network will participate very actively in the event, notably through the presentation of numerous papers, the distribution of the present issue of the EUROSAFE Tribune devoted to ETSON and the preparation of the next issue focused on the outcome of the conference.

Coached by senior experts from ETSON member TSOs, ENSTTI trainees and tutees participate in breakdown sessions where they use e.g. simulation tools to build their practical skills.

ENSTTI NEWS

Eight courses are open for registration for the November-December period of 2014. The topics addressed encompass the lessons learned from the Fukushima Daiichi accident and the EU stress tests, the evaluation of safety culture, emergency preparedness and response, safety assessment and regulation of the decommissioning of nuclear facilities. More on: www.enstti.eu > Training

ETSON TRAINING

• Courses

A two-day ETSON course on the management of EU research projects was organised in Paris on 3-4 April 2014.
The corresponding self-training contents are available at: www.etson.eu

ETSON PUBLICATION

• Guides

Meant to complement the *Safety Assessment Guide* (SAG) published in January 2013, a new *Technical Safety Assessment Guide* (TSAG) on Transient and Accident Analysis (EG10) gives a view on commonly accepted practices for review by TSOs of safety files submitted by licensees concerning safety fluid systems.
The document is available at www.etson.eu > Information Center > Reports & Publications.

Stakes & Goals

While the stakes and goals associated with nuclear safety, security and radiation protection basically remain unchanged, the context has evolved tremendously following the occurrence of three severe reactor accidents and decisions by several countries to embark on nuclear power programmes. A challenge ETSON member TSOs are taking up through ever-closer cooperation.

Born to take up nuclear safety challenges

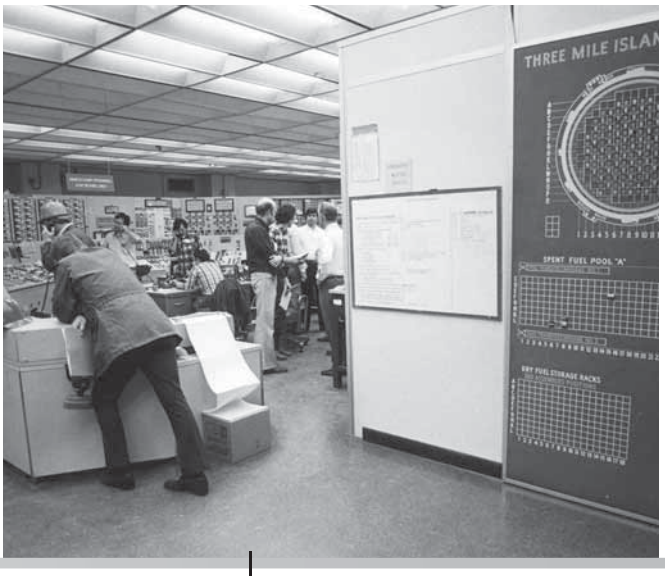
Taking a look in the rear-view mirror

Founded in 2006 by AVN (later Bel V), GRS and IRSN, the European TSO Network (ETSON) appears to be a fairly young organisation. But in fact, its member TSOs – in their current or previous forms – have been collaborating on safety issues since the 1970s, when the spread of nuclear energy in Western countries triggered debate about the physics of accidents and the models to represent them...

Experiments play a major role in the R&D performed by ETSON member TSOs, as evidenced by the result of this thermal test performed to assess the resistance of glove boxes to fire.

ETSON: leveraging TSO capabilities

The roles, functions and missions of European Technical Safety Organisations (TSOs) differ, depending on the respective national framework conditions. In spite of these distinct regulatory conditions, European TSOs cooperate in the framework of ETSON to form a suitable forum for voluntary exchanges on analyses and R&D in the field of nuclear safety and to share experience and exchange technical and scientific opinions, to establish and harmonise best practices in nuclear safety, especially in safety assessment, and to promote and coordinate nuclear safety research, both inside the network and in all international organisations in charge of nuclear research.



1979

The Three Mile Island (TMI-2) accident gives a strong incentive for a first international assessment of NPPs' ability to withstand accidents. Many lessons are learned in areas such as man-machine interfaces, plant safety design and accident physics.

80

The far heavier consequences of the Chernobyl accident stop the nuclear industry's expansion for decades and call safety culture into question. Taking stock of the trans-border impacts of the accident, the European Commission decides to provide the first safety support to a non-EU country, thereby setting up propitious conditions for the creation of a joint venture called Riskaudit by GRS and IRSN's forerunner IPSN.

1986

Current safety issues

New issues have arisen in the aftermath of the Fukushima NPP accident. Firstly, the stress tests performed on the EU's reactor fleet have shown that progress has to be achieved in areas such as taking into account external events with a very low probability of occurrence or combined events, and coping with them; (re)assessing the plants' safety levels with regard to these events and their possible outcome; considering plant upgrades such as a hardened safety core in order to prevent and mitigate core meltdown events should they occur; upgrading old plants to these new standards or closing them down; and improving the organisations' emergency preparedness and response capabilities. Secondly, the revised EU safety directive poses other challenges: whereas the 2009 directive was rather simple and prescribed only existing requirements, the 2014 directive calls for more independence and clarification of the role of safety authorities and more participation in the Integrated Regulatory Review Service (IRRS) missions, and it recognises the role of the TSOs in many EU countries. Last but not least, the growing globalisation of the nuclear industry calls for a more international regulatory framework with an increasing number of participants (which makes reaching a consensus more difficult) and for more uniform safety level evaluations (which means overcoming the complexity of different regulatory backgrounds).

New endeavours for ETSON

Given these emerging issues, the ability of ETSON member TSOs to enhance nuclear safety, security and radiation protection calls for emphasis to be placed on six primary initiatives.

• One is **the continued improvement of safety assessment methods,** based on the development of a common Safety Assessment Guide (SAG) supplemented by a growing number of Technical Safety Assessment Guides (TSAGs). Their aim is to ensure that safety assessments are performed based on the same principles and can therefore be trusted with the same level of confidence, regardless of the TSO or the country concerned by the assessment. This is a decisive precondition for reaching a situation where

06

The EUROSAFE initiative is launched by the German and French TSOs to foster convergence of nuclear safety practices by sharing knowledge and operating experience feedback.

1999

2006

ETSON is founded and turned into an association in 2010 to support the network's rapid expansion and provide a stronger base for the sharing of current activities and the development of new activities in the wake of the Fukushima NPP accident.

The Junior Staff Programme is launched, bringing together young experts from ETSON's member TSOs tasked with joint projects. That same year, the first worldwide IAEA TSO Conference takes place in France, hosted by IRSN.

2007

"safety" has the same weight and content throughout Europe. Available on the ETSON website, the TSAGs are not meant as a compilation of requirements but as guidance for safety reviews. They are living documents which will be updated on an as-needed basis, and they will gradually incorporate the experience gained.

• Another initiative to align safety practices is **to devote sufficient resources to the ETSON Junior Staff Programme** (EJSP) so that participating young experts can establish a network for efficient cooperation and transcultural interaction.

• **To make sure that safety issues are adequately dealt with in nuclear research programmes,** ETSON must continue to be well represented in the governing bodies of the Sustainable Nuclear Energy Technology Platform (SNETP) as well as in linked associations such as NUGENIA, the European Sustainable Nuclear Industrial Initiative (ESNII) and the Nuclear Cogeneration Industrial Initiative (NC2I).

• A fourth key initiative aimed at harmonising approaches and practices in nuclear safety, security and radiation protection is **to support the expansion of the European Nuclear Safety Training and Tutoring Institute** (**ENSTTI**) from its initial role as training provider to one of professional career designer through its involvement in European projects such as NUSHARE, the Instrument for Nuclear Safety Cooperation (INSC) and the Sustainable Network of Inde-

11

2011

The newly founded European Nuclear Safety Training & Tutoring Institute (ENSTTI) organises its first training courses.

11 March 2011

The 9.1 earthquake and subsequent tsunami result in the destruction of 3 out of the 4 units of the Fukushima Daiichi nuclear power plant.

These historical milestones clearly show that the European TSOs have never stopped strengthening their ties to take up the challenges of the moment.

pendent Technical Expertise for Radioactive Waste Disposal (SITEX). These different European projects put ENSTTI in a pivotal position to take part in defining and preparing the forthcoming professional passport of nuclear safety experts at technical safety organisations and safety authorities, and to offer them both professional curricula and the corresponding skills and qualifications validation system.

• **To stimulate technical discussions between ETSON partners** and to allow for the exchange of fresh information, ETSON's workshops on current topics should be pursued sustainably. For the record, workshops were organised between 2011 and 2014 on topics such as the Fukushima NPS accident, EU stress tests and post-Fukushima research, with participants agreeing on follow-up activities as part of their working programme.

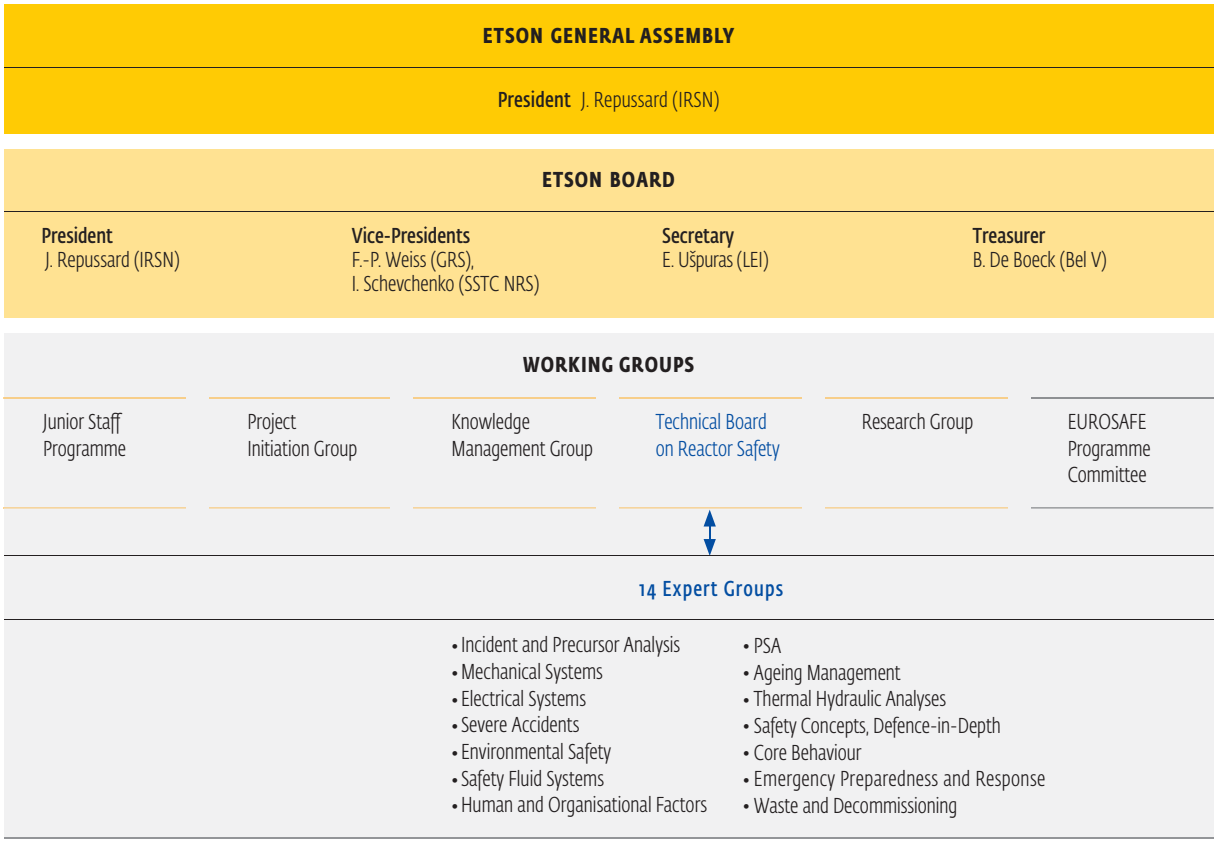
• The last major initiative is **the dissemination of knowledge, methods and practices**. In view of its international reach, the IAEA's International Conference on Challenges Faced by TSOs in Enhancing Nuclear Safety and Security is an appropriate arena for conveying messages to the nuclear safety community worldwide. ETSON member TSOs are involved in the scientific and organisational preparation of the conferences, present papers, lead discussions, and contribute to the evaluation and implementation of recommendations. The TSO Forum (TSOF) founded in January 2012 is part of the IAEA's Global Nuclear Safety and Security Network (GNSSN), which is open to TSOs from all IAEA member states. Its objective is to contribute to the worldwide harmonisation of nuclear safety practices through open dialogue and the sharing of scientific and technical information between TSOs.

The continuing interest shown by TSOs in joining ETSON, either as a member or an associate member, and requests for close cooperation with the Network encourage its member TSOs to continue along the path they have taken. ✖

Learn more:

Visit ETSON's website for further information on the network and its activities: www.etson.eu

ETSON general organisation



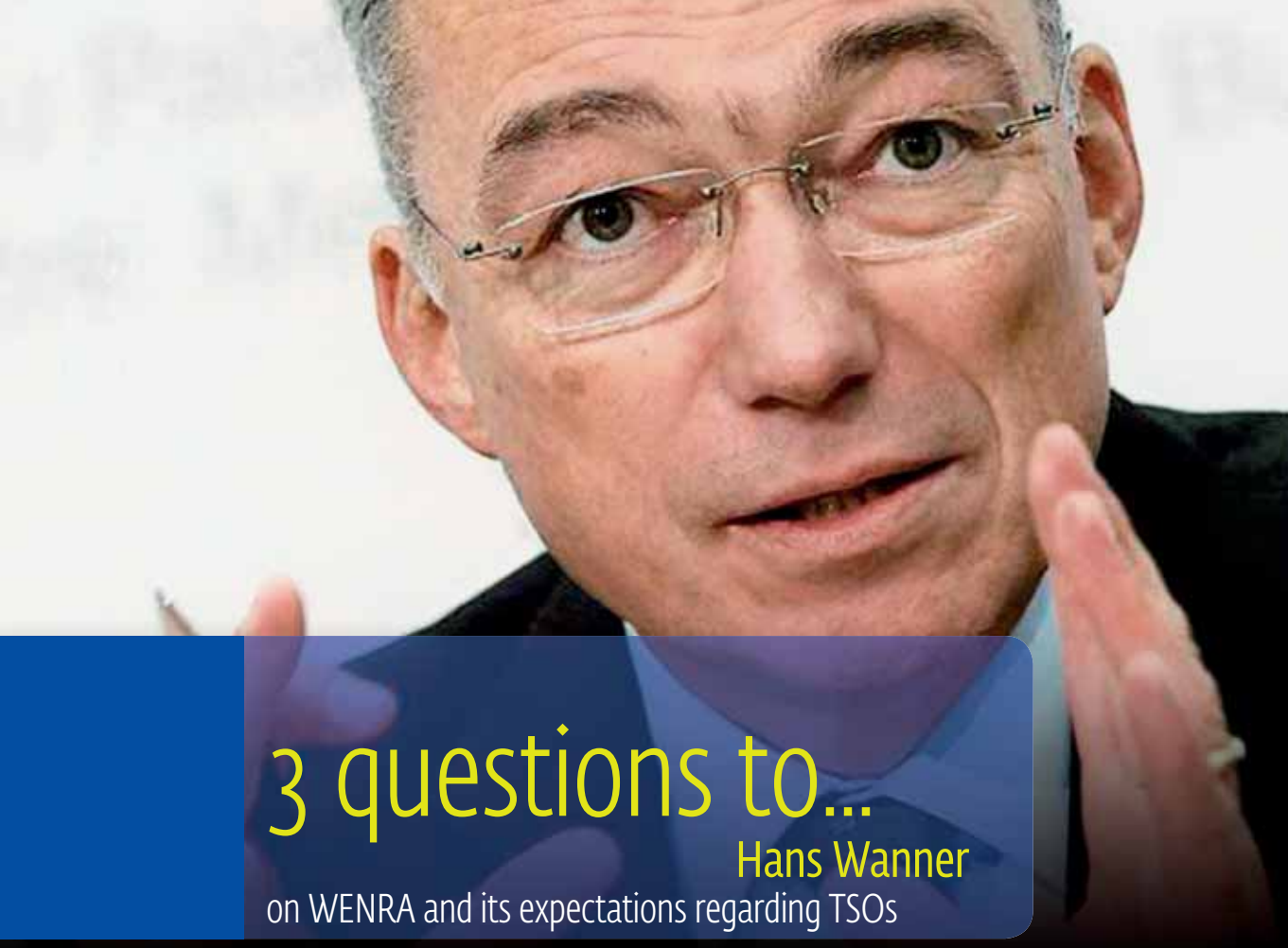
ETSON: An efficiency-oriented organisational model
The general organisation of ETSON is shown above.

- The General Assembly is the highest decision-making body of ETSON, while the Board is the executive body. Both the ETSON General Assembly and the ETSON Board are chaired by the President.
- The Board and the Assembly are supported by five dedicated groups plus the EUROSAFE Programme Committee. These groups report directly to the Board.
- The Technical Board on Reactor Safety, assisted by the Research Group, coordinates fourteen Expert Groups on technical issues.
- The Expert Groups represent the technical and scientific base of ETSON and bring together leading experts from all ETSON members, thereby helping to strengthen and harmonise safety standards and best practices as well as nuclear safety assessment methods and procedures in Europe.

Decision-making body

Executive body

All 5 working groups and EUROSAFE Programme Commitee report directly to the board



3 questions to...

Hans Wanner

on WENRA and its expectations regarding TSOs

Hans Wanner, Director General of the Swiss Federal Nuclear Safety Inspectorate (ENSI), is Chairman of the Western European Nuclear Regulators Association (WENRA). WENRA consists of the heads of Nuclear Regulatory Authorities of European Union (EU) countries with nuclear power plants and Switzerland.

What are the major future challenges in the fields of nuclear safety, security and radiation protection?

The main objectives for nuclear safety in Europe, and the world, is in our view the harmonisation of safety requirements and continuously improved nuclear safety. This is what WENRA is striving towards, both for existing nuclear power plants, in particular regarding long-term operation until final shutdown, as well as new builds. Regarding security and radiation protection, WENRA is not directly involved in these areas. ENSRA (European Nuclear Security Regulators Association) is our partner organisation in the security field. We will probably need closer coordination between our two associations relating to the safety-security interface on a European level in the future. With regard to radiation protection, WENRA has just created a task force with the Heads of the European Radiological protection Competent Authorities (HERCA). The objective is to harmonise emergency response in the early phase in case of an accident. I think another important challenge for Europe is to invite embarking countries in its vicinity to share WENRA's view on harmonisation and continuous improvement.

In this respect, what are WENRA's objectives for the coming years?

We have just finalised an important step in updating the Safety Reference Levels (SRL) in the light of the Fukushima accident. The updating process will now be extended to other safety areas with regard to the developments in the last decade and the future challenges in nuclear safety. This will also include SRL for new reactors. In addition to this, implementation of the SRL in nuclear power plants will be closely monitored in the next years in tandem with the planned EU-wide topical peer review system, as defined in the newly drafted European nuclear safety directive. Also, I think it is important that WENRA continue to deal with safety issues of generic relevance for European nuclear power plants. A good example is the WENRA recommendation based on hydrogen flaws found in Belgian reactors. In my view, feedback from the inspections made following this recommendation illustrates a harmonised European safety approach and can help assure the public about the safe operation of European nuclear power plants.

What are WENRA's expectations regarding the European TSO Network (ETSON)?

I would say that WENRA is a centre of nuclear safety expertise in Europe. This position is possible only with the support of the TSOs in ETSON. In the process of harmonisation and continuous improvement, it is indispensable to have the best technical expertise available in Europe, and I think this is the main contribution of ETSON. In order to cope with the future challenges and developments within the field of nuclear safety, it is in my opinion crucial to have access to the state of the art in science and technology. This is provided via *the ETSON members.*

Jumping over the expectations' bar

In their daily practice, TSOs must meet a wide array of expectations, from preventing accidents to mitigating them, from managing emergency situations to informing the public. Fulfilling these duties requires that all stakeholders work closely together and support each other to create and apply the necessary knowledge and know-how, across and beyond Europe. This in turn requires adequate resources, including top-notch experts, funding and global networking, as explained by Eugenijus Uščpuras from the Lithuanian TSO Lithuanian Energy Institute and Leon Cizelj from the Slovenian TSO Jozef Stefan Institute.

The role of the TSO

Decisions made by regulatory authorities should be based on the best available science and experience. However, large parts of the scientific and technical expertise related to nuclear safety are frequently available outside the national regulatory bodies, in independent organisations called TSOs. "While their roles largely result from the historical development of nuclear matters as well as from the existing legal system in each particular country, a common role within the national nuclear safety frameworks in such cases is to provide independent scientific and technical support or advice to the competent regulatory body, which retains the responsibility for regulatory decision-making," Eugenijus Uščpuras notes. The kind of support provided may vary from country to country, but it generally includes regulatory research, preparation of draft legislation, regulatory rules, and safety assessments of plant operations and modifications proposed by the operators, among many other things. TSOs therefore actively contribute to the prevention of incidents and accidents and to the mitigation of their consequences.

The scientific and technical expertise available within a TSO may also be crucial to building and maintaining public perceptions of the safety of nuclear installations. "In some coun-

tries, the TSOs and their experts act as true moderators between the nuclear community and the public at large," explains Leon Cizelj. "Some can provide expertise as regards the siting of nuclear facilities at the request of people living in the neighbourhood of a potential site. They can contribute to increasing public confidence by providing information on the scientific bases of decisions, independently of political and economic interests. They can also contribute to public information by adopting non-specialist language and making technical subjects accessible to laymen." TSOs thus play a significant role when it comes to public information, not only in an emergency situation, but also on a daily basis.

Key values of the TSO

To provide the best available advice to nuclear regulatory bodies, TSOs must adhere to key values such as independence of judgement, a holistic approach to safety expertise and a high level of competence. These are core values for ETSON and its member TSOs.

Left page:
Tanks filled with contaminated water pending reprocessing at the Fukushima NPP.

Opposite:
TSO experts participating in a crisis management task-force meeting.

Gaining diversity in thinking

"Nuclear safety is obviously a global concern; it is not a concern of any one country. Subsequently, collaborating is key to solving safety issues in an efficient and cost-effective manner. At the US NRC, we see major benefits from our collaboration with ETSON and its member TSOs. The first is the value of the expertise we – and our ETSON counterparts – gain mutually by sharing technical information, knowledge and experience. Another benefit from working closely with our counterparts in Europe on common problems is that we are really gaining diversity in thinking. Understanding how other TSOs not only characterise the problems but also are proposing to address them, factoring their opinions and experiences into our own work is conducive to better solutions to safety issues. Moreover, cooperation in research allows resource money to be leveraged on both sides: if we both contribute financially to carrying out the programmes to resolve safety issues, we save money we would have to spend if we tried to solve the issues by ourselves.

I think a regulator needs a strong technical base in order to make correct decisions. Thus, for new nations who are starting up in nuclear, who are planning nuclear plants, it is extremely important to focus on making sure that they all have robust technical safety organisations available to support the regulatory programmes. I would therefore strongly encourage them to collaborate internationally with other TSOs participating in the IAEA TSO Conference."

Brian Sheron
Director, Office of Nuclear Regulatory Research
US Nuclear Regulatory Commission

"Independence of judgement ensures that external interests do not unduly influence the analyses and advice produced by TSOs. These are therefore normally operated as non-profit organisations guided by a values charter and a code of ethics meant to avoid conflicts of interests," Mr. Uškuras notes. "A holistic approach to safety expertise ensures that the TSO is capable of supporting regulatory authorities – and reporting to the general public – with a comprehensive vision of issues, on a regular basis," he adds.

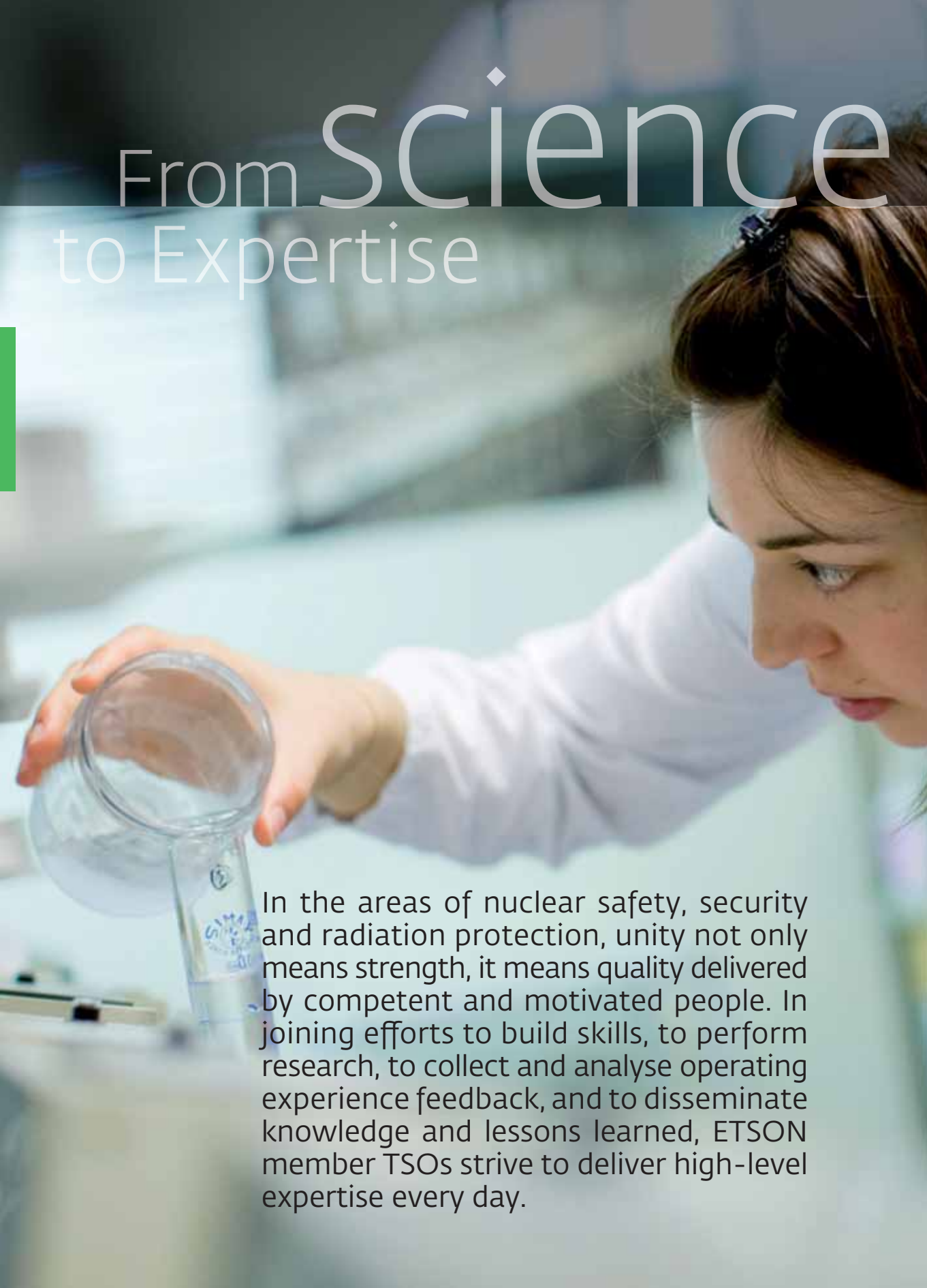
TSOs are often expected to integrate the national mechanism set up to monitor the post-accident phase and accompany the population living in contaminated areas.

The continuous improvement of competence requires the TSO to lead distinctive long-term research programmes, regular analyses of operating experience feedback, training and tutoring, knowledge management and, ultimately, global networking among nuclear safety experts.

To maintain their knowledge, TSOs need to stay at the forefront of technological development, to be involved in the nuclear licensing and supervision process, and to participate in national and international research and development programmes as well as in networks devoted to exchanging information and lessons learned.

As a science-based activity, nuclear safety assessment requires sustained research and development efforts if safety issues are to be addressed appropriately by TSOs and regulatory authorities. In this respect, international cooperation in research programmes on safety-related issues is key to enhancing the TSOs' scientific level. "As major undertakings to consolidate input from the European TSOs, the EUROSAFE initiative and the ETSON network contribute to the discussion of safety-relevant issues at an international level, to the promotion of harmonisation of nuclear safety practices and to the joint management of nuclear safety research programmes," Leon Cizelj concludes.

From science to Expertise



In the areas of nuclear safety, security and radiation protection, unity not only means strength, it means quality delivered by competent and motivated people. In joining efforts to build skills, to perform research, to collect and analyse operating experience feedback, and to disseminate knowledge and lessons learned, ETSON member TSOs strive to deliver high-level expertise every day.

Fuelling expertise

Far from depending only on academic scientific knowledge, the expert assessment of nuclear facilities requires technical experience, behavioural skills and easy access to a network of fellow experts capable of peer-reviewing one's own analyses and conclusions. This approach was conducive to the creation of the European Nuclear Safety Training & Tutoring Institute (ENSTTI) by ETSON.

98%

of trainees and tutees successfully pass the exams at the end of their internship at ENSTTI. The outstanding success rate is a clear sign that the knowledge and experience dispensed in each course are matched to the specific needs of each individual intern.

Beyond science: experience

The TSOs' primary mission is to provide expert support to nuclear regulators for the assessment of nuclear safety, physical protection and radiation protection of nuclear facilities and radioactive sources. They therefore need to rely upon highly qualified staff with specialised knowledge in a wide range of areas, starting with national nuclear legislation and including international requirements as well as guidelines and current best practices. TSOs must also have people capable of performing assessments of design-basis and beyond-design-basis accidents (extended design conditions), including severe accidents, and of analysing operational events, especially non-standard transient processes initiated by multiple failures of certain components and systems. This requires an in-depth understanding of deterministic as well as probabilistic risk assessment methods, among other things. In addition to the knowledge of precursors and root cause analyses, a detailed understanding of NPP technology systems, including their operating procedures, is absolutely necessary.

Moreover, TSOs should be able to assess the physical condition of components and systems important to nuclear safety and to check the validity of their safety qualifications and remaining service life. This requires skills in the field of materials engineering and knowledge of non-destructive testing methods and of related laboratory and experimental facilities, including hot cells.

Today, the competencies of a TSO staff encompass knowledge of radioactive waste management, radiation protection, accident management and emergency preparedness, physical protection, safety culture, and more. Since all of these disciplines evolve over time, it is the responsibility of state authorities to ensure their steady progress and implementation of state-of-the-art knowledge and practices in their respective countries. Updating knowledge and practices requires resources that TSOs do not necessarily have internally. In such cases, pooling resources in one common training and tutoring organisation such as ENSTTI is an efficient way to benefit from the knowledge and experience of the entire TSO community.

118 trainers and 23 tutors delivered courses to 243 trainees and 15 tutees in 2013. This exceptionally high ratio of trainers and tutors to trainees and tutees offers assurance of efficient mentoring by senior experts capable of providing extremely specialised courses.

Beyond knowledge: know-how

Transferring skills, promoting an original safety culture and recognising that TSOs must be capable of delivering collective expertise: this is what ETSON's ethics are built upon. ETSON is fully aware of the need to transfer knowledge, but more importantly know-how, behavioural skills and cultural features, since a full-fledged expert not only needs in-depth theoretical knowledge but also practical skills in performing research, analyses, inspections, work planning, etc. This is what training and tutoring at ENSTTI are all about.

For ENSTTI, a competent TSO expert must obviously have the required technical knowledge to question the operator. This is a necessary but insufficient prerequisite. A competent expert must also be capable of continually questioning decisions, processes and actions, because that questioning, which takes into account the most pessimistic assumptions, is the key to quality assessments. Nuclear facilities and operations are usually highly complex, and each individual expert masters only part of that growing complexity, making collective expert knowledge and practices increasingly irreplaceable. This means that experts must learn to network with their counterparts across the world and to confront their own approaches with those of others. Building up a worldwide network of senior experts from different organisations to coach junior experts from TSOs, NRAs, etc. is also what training and tutoring at ENSTTI are all about, as summed up by the Institute's corporate slogan: '*Experts for experts*'.

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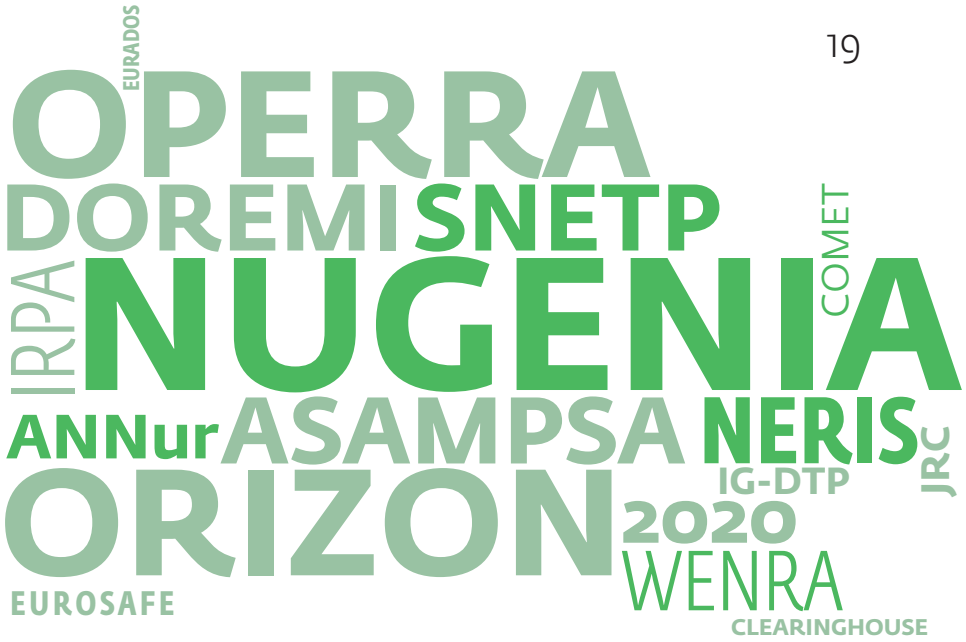
Unity makes strength

Rauno Rintamaa is Senior Advisor, Energy Systems and Nuclear Technology, at VTT, a major TSO in Finland. A former Vice President of ETSON, he is currently Vice President of NUGENIA, mandated by SNETP to coordinate Generation II and III R&D. He provides his views on the benefits of pooling research.

CAN YOU GIVE SOME BACKGROUND ON THE POOLING OF NUCLEAR RESEARCH PROGRAMMES IN EUROPE?

The building blocks for the pooling of nuclear research were present in Europe as early as 2006, in the form of several European networks of excellence: the NULIFE research network for nuclear plant life prediction, the SARNET severe accident research network and, in 2007, the Sustainable Nuclear Energy Technology Platform (SNETP). The latter was launched following the European Commission's Strategic Energy Technology Plan (SET-Plan), which established an agenda for long-term energy research in Europe. The main idea of the SET-Plan was to use available resources in a smarter way through joint strategic planning and programming.

The value of consolidating all these networks and resources was becoming more apparent, and the SNETP and NULIFE Governing Boards decided to integrate their activities in an international non-profit association, NUGENIA, founded in late 2011. In early 2012, SARNET and the European Network for Inspection Qualification (ENIQ) also integrated with NUGENIA. The reality, of course, is that NUGENIA is still in the process of integrating its four networks, but it is nonetheless a starting point for a more united community that shares nuclear research to support safe, reliable and efficient nuclear power plant operation.



WHAT ARE SOME EXAMPLES OF JOINT NUCLEAR RESEARCH PROJECTS?

Last year was a busy year at NUGENIA, with the consolidation of our project portfolio (9 were inherited from NULIFE), the launch of the NUGENIA Open Innovation Platform (NOIP), and publication of our roadmap. The roadmap sets high-level objectives used to prioritise R&D and to launch projects with high added value to the end-user. Several projects were successfully completed in 2013, such as the LONGLIFE study (on the effects of long-term irradiation embrittlement in reactor pressure vessel safety assessment) or the HARMONICS project (for harmonised assessment of the reliability of modern nuclear I&C software). New projects were initiated, including the NURESAFE simulation platform for nuclear reactor safety, SAFEST (severe accident experiments), ACCEPPT (aging of concrete and civil structures in nuclear power plants) and ADFAM (fatigue assessment of critical components). An important new project is NUGENIA+, which aims to enlarge our ability to provide technical and scientific solutions through collaborative R&D and to implement the specific priorities of the NUGENIA road map.

> "NUGENIA is a starting point for sharing nuclear research to support safe, reliable and efficient NPP operation."
>
> **Rauno Rintamaa**
> Senior Advisor, VTT
> Vice President, NUGENIA

WHAT ARE THE CHALLENGES FOR GOVERNANCE OF POOLED RESEARCH?

One of the challenges is that each European Union Member State has its own nuclear safety legislation and regulations. The question is how to harmonise safety requirements, and what the technical methods should be for safety assessment. This area is an important link between NUGENIA and ETSON. Driven by its primary goals of harmonising nuclear safety assessment practices in Europe and defining and implementing coherent European research programmes, ETSON produced a position paper in 2011 (*Position paper of the TSOs: Research needs in nuclear safety for Gen 2 and Gen 3 NPPs*) identifying several nuclear safety research priorities. Safety assessment harmonisation is at the top of ETSON's list, and it is very closely involved in NUGENIA's efforts in that area. ✖

Learn more:

The position paper of the TSOs: Research needs in nuclear safety for Gen 2 and Gen 3 NPPs is downloadable at www.etson.eu > Information Center > Reports & Publications

Inspection conducted at Chinon A3 NPP (France) as part of the examination of the safety case pertaining to the dismantling of the plant's heat exchangers.

Delivering high-level expertise

On the right: Supporting regulators during safety inspections at operators' facilities is part of the work performed by TSO experts.

When it comes to delivering high-level expertise, it is obvious that pooling resources and sharing results is becoming increasingly important for several reasons, such as the very high cost of experimental facilities, of computer code development, and of education and training (E&T) programmes, and the need to exchange best practices in order to raise and harmonise safety approaches to as high a level as possible. An important driving force for the creation of ETSON was the opportunity to achieve this high-level expertise not only within the different TSOs, but also through cooperation in different areas.

Learning from each other

"An important aspect of achieving high-level expertise is the possibility to learn from each other," stresses Benoît De Boeck, General Manager of the Belgian TSO Bel V. With its Expert Groups overviewed by a Technical Board on Reactor Safety, ETSON is the right place for high-level exchanges on nuclear safety and radiation protection. Moreover, common approaches on basic principles of safety assessment or on regulatory review work in specific technical domains are documented in *Safety Assessment Guides**. Pieter De Gelder, Head of the Nuclear Safety and Radiation Protection Assessment Department at Bel V, notes that "providing mutual support amongst the TSOs confronted with new activities or a temporary lack of manpower in a given technical domain was also a basic idea for creating ETSON." For ETSON member TSOs, cooperation in international projects – notably in R&D or assistance projects to embarking countries – contributes to the achievement of high-level expertise by

**More information can be found in another article in this EUROSAFE Tribune entitled 'The past and current stakes of nuclear safety, security and radiation protection'.*

Safety engineers belonging to ETSON member TSOs offer their expert knowledge and experience to assist local authorities as part of several new build projects worldwide, e.g. in China (*left*) and in the UAE (*right*).

bringing new insights to the organisations contributing to the project.
Chief research associate at the Lithuanian Energy Institute (LEI) Algirdas Kaliatka emphasises the benefit of networking with others for TSOs from countries with a small nuclear programme: "A member of ETSON in 2009, LEI also joined ENSTTI in 2010, providing trainers for the induction courses. Today, LEI is providing trainers for the advanced-level courses in nuclear safety and is organising internships." LEI also participates in several FP7 projects, including ARCADIA, ASAMPSA-E, CESAM, MATTER, NC2I-R and SARGEN IV, and in INSC projects in Armenia, Belarus, etc. In addition, LEI is a member of NUGENIA, an association dedicated to R&D on nuclear fission technologies, with a focus on Generation II and III nuclear plants.

Leveraging experience feedback

Providing high-level expertise requires a comprehensive understanding of operating experience feedback (OEF). "This is why we TSOs initiated the establishment by European nuclear safety regulators, in 2008, of the European Clearinghouse on Operational Experience Feedback for NPPs, with the aim of fostering collaboration on OEF, disseminating lessons learned from NPP operating experience, and promoting advanced event assessment approaches and methods," recalls Michael Maqua, Head of the Plant Engineering Department at GRS' Reactor Safety Analyses Division. "The extended knowledge of both IRSN and GRS in the evaluation of operating experience in France and Germany is used by the Clearinghouse with the objective of gaining detailed insights into safety-related topics," he adds. Both TSOs produce joint reports on safety issues that are then combined in a European Clearinghouse report, which also includes reviews of the NEA/IAEA International Reporting System (IRS) on Operating Experiences and the US NRC Licensee Event Reports carried out by the Joint Research Centre (JRC) of the EU. In their topical reports, IRSN and GRS analyse in detail the origins, root causes, contributing factors, consequences and lessons learned of respective national events. Each report contains a set of specific and generic lessons learned that allow regulators, TSOs and the industry to properly address safety-relevant issues in order to implement suitable improvement measures. ●●●

> "For ETSON, passing on safety culture to their counterparts in accessing countries is an essential way to help them achieve a high level of expertise."
>
> **Michel Chouha**
> Co-managing Director
> RISKAUDIT IRSN/GRS

3 questions on...

the EC's expectations regarding TSOs

Dr Massimo Garribba is the Head of Directorate D – Nuclear Energy of the European Commission's (EC) Directorate-General (DG) for Energy.

What role do TSOs play in implementing the existing and amended safety directive?

The existing safety directive [1] does not explicitly refer to TSOs, but we know perfectly well that their role has been quite significant. The proposed amendment to the safety directive includes provisions for topical peer reviews related to the safety of nuclear installations, to be conducted every six years. The added value that TSOs could bring to such peer reviews is explicitly mentioned in the proposed amendment. The amendment thus creates an area for potential cooperation with TSOs.

Nonetheless, the TSO landscape is a mixed picture, with regulators using TSOs differently from one country to the next: some use in-house technical expertise, others rely entirely on one or more TSOs, which can sometimes be located abroad. It is difficult to get a coherent picture, and this can be a challenge. Future projects will depend most critically on national regulators, which are the main interface for DG Energy.

How has cooperation between the European Commission and TSOs evolved?

Much has happened to increase cooperation generally since the Fukushima accident. DG Energy participates in several initiatives in which TSOs are associated. For example, together with DG RTD (Research & Innovation), our cooperation in NUGENIA's 'standardisation' project is well established, with the goal of supporting the competitiveness of European nuclear energy by establishing a technical basis for standardisation of reactor systems and components.

We also have ties with ENSTTI through the NUSHARE project of the European Nuclear Education Network (ENEN), originally a EURATOM Education & Training initiative proposed by DG Energy and DG RTD. ENSTTI provides expertise and a training facility, and is a key contributor to awareness-raising in safety culture, not only in Europe but around the world. DG DEVCO (Development & cooperation) also uses ENSTTI for the dissemination of EU know-how in non-EU countries, for example through training and tutoring projects. Within the framework of the Instrument for Nuclear Safety Cooperation, DG DEVCO uses the resources of EU TSOs to implement specific cooperation projects (Armenia, Belarus, Egypt, Jordan, Southeast Asia, Ukraine, etc.).

Another important area of cooperation is through the European Clearinghouse on Operational Experience for NPPs, which brings together the building blocks of NPP operating experience from the field and shares it with licensees, regulatory authorities and their TSOs. The TSOs of a number of EU countries are involved in detailed assessments of operational events of particular interest.

What about EC cooperation on nuclear safety with the IAEA?

The EU and the IAEA have cooperated on nuclear safety for many years. Recently, I would point to the EU nuclear stress tests, which set a global benchmark and contributed to the IAEA's Action Plan on Nuclear Safety. *Last September, the EC (DG Energy) and the IAEA strengthened this cooperation by signing the Memorandum of Understanding on Nuclear Safety, which lays the groundwork for more structured cooperation in areas such as expert peer reviews and emergency preparedness and response. By contributing our European expertise, we will be helping to ensure that nuclear energy is produced safely all over the world.* ✖

(1) Directive 2009/71/EURATOM establishing a community framework for the nuclear safety of nuclear installations.

Learn more:

The EJSP Summer Workshop 2014, held in Finland, was devoted to "Fuel Management", covering the nuclear fuel cycle from mining and fabrication to usage and disposal.
More information can be found at:
http://www.etson.eu/Initiatives/Pages/JSP.aspx

Involving junior experts

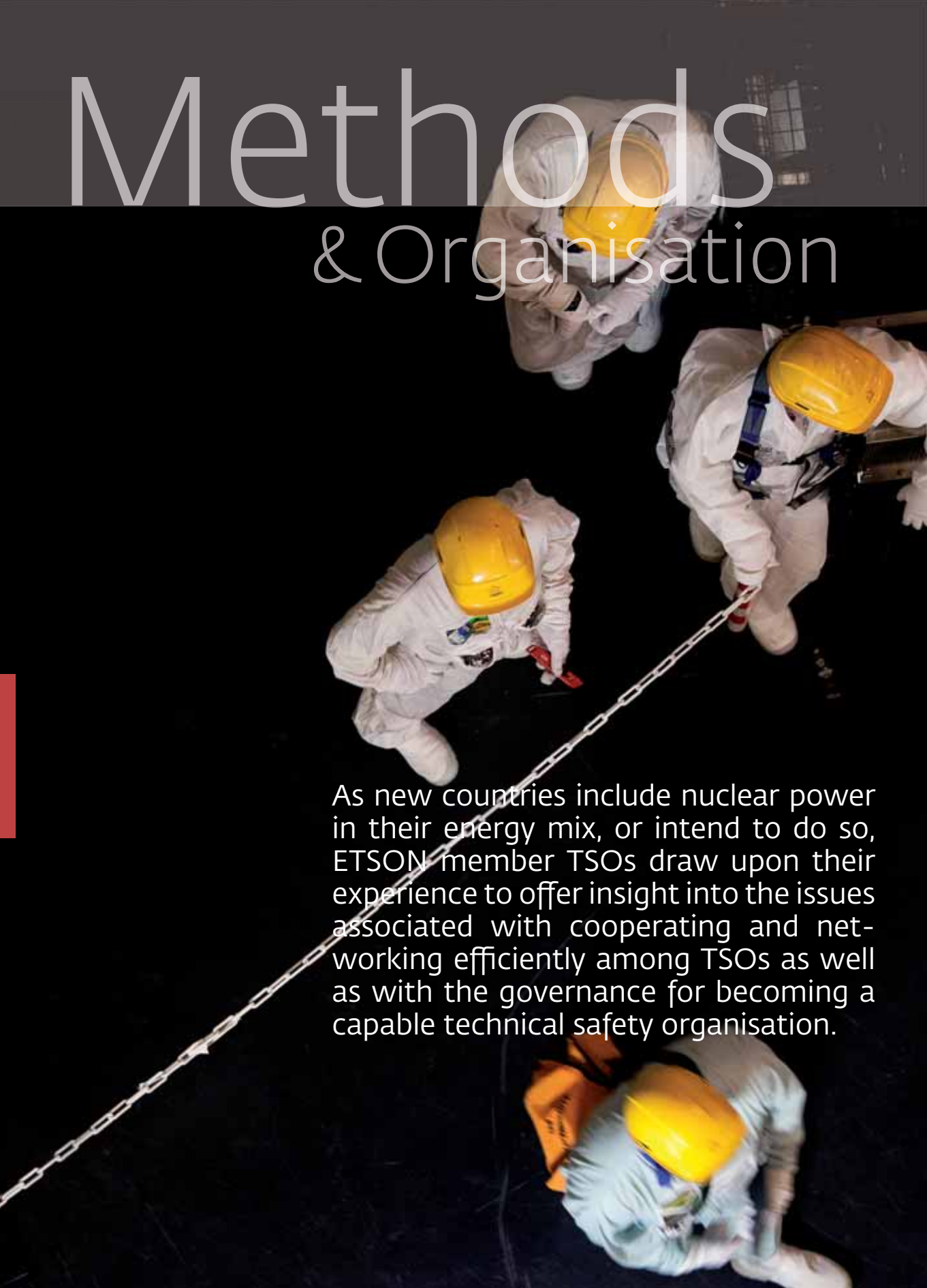
ETSON member TSOs were actively involved in initiatives such as the creation of the European Economic Interest Grouping (EEIG) RISKAUDIT, aimed to provide assistance to countries (e.g. Ukraine) outside the EU, or the set-up of the European Joint Staff Project, aimed to build up transboundary expert teams.

Achieving a high level of expertise largely depends on the ability of experts to network in their own field of expertise, to improve technical knowledge through international cooperation and to participate in the development of a European strategy for improving nuclear safety. "The ETSON Junior Staff Programme (EJSP) launched by GRS and IRSN in 2003 brings together young experts from all ETSON members and associates with a view to improving the long-term partnership of the member TSOs, establishing a cooperation network between young experts from different countries, and encouraging intercultural interaction," explains Tchien Minh Tang, safety analyst in Bel V's Nuclear Safety & Radiation Protection Assessment Department. "With that in mind," he adds, "an ETSON Junior Staff Summer Workshop has been organised annually since 2008 to enhance and intensify collaboration among young ETSON experts. All participants in this Summer Workshop are also speakers. They are asked to prepare a joint presentation or a safety case. Participants are then divided into working groups, ideally from different TSOs. This creates an environment where all participants can work together on a specific topic and allows them learning from each other."

In Europe and beyond...

"After fifteen years of relentless effort, the NRAs and TSOs of former countries of the USSR concerned by the Technical Assistance to the Commonwealth of Independent States (TACIS) programme set up by the EU in the wake of the Chernobyl accident have achieved substantial progress, particularly in the fields of nuclear safety and radiation protection," Michel Chouha observes. The Co-managing Director of RISKAUDIT IRSN/GRS International, a non-profit European Economic Interest Grouping established in 1992, goes on to say that "the increased interest in nuclear power shown worldwide by countries without any experience in this field led the EU to set up the Instrument for Nuclear Safety Cooperation (INSC) in 2007." As part of this new cooperation programme, ETSON member TSOs participate actively in passing on safety culture to their counterparts in accessing countries, drawing on the EU's long experience in nuclear safety, security and radiation protection. "This is an essential way to help these countries achieve a high level of expertise," concludes Michel Chouha.

Methods & Organisation



As new countries include nuclear power in their energy mix, or intend to do so, ETSON member TSOs draw upon their experience to offer insight into the issues associated with cooperating and networking efficiently among TSOs as well as with the governance for becoming a capable technical safety organisation.

Equality, openness, harmonisation: **the ETSON creed**

Ensuring the highest level of expertise, safeguarding the TSOs' independence of judgement, aligning safety practices… To achieve these and other objectives, ETSON member TSOs have established pragmatic rules for efficient work. Deputy Director of the IRSN International Affairs Division Édouard Scott de Martinville and representatives of different ETSON counterparts provide insights hereafter.

Expertise, the quintessence of safety assessment

"Besides a definite regulatory framework to be applied to the facility concerned, the safety assessment of a given nuclear plant requires above all in-depth technical knowledge of the installation by the bodies in charge of safety inspections and safety assessment," Édouard Scott de Martinville stresses. "It also requires up-to-date knowledge in a broad variety of disciplines to be able to carry out a critical analysis of the licensee's scientific development, as well as extensive experience on the given plant and on similar facilities," he adds.

Based on this observation, ETSON member TSOs have developed a shared set of methodologies based on practice. After publishing a generic *Safety Assessment Guide* drawing upon several decades of experience, they are issuing *Technical Safety Assessment Guides* aimed at providing guidance for reviewing and anchoring state-of-the-art knowledge and competence. All these documents are to be updated periodically.

Networking, an essential foundation for up-to-date knowledge

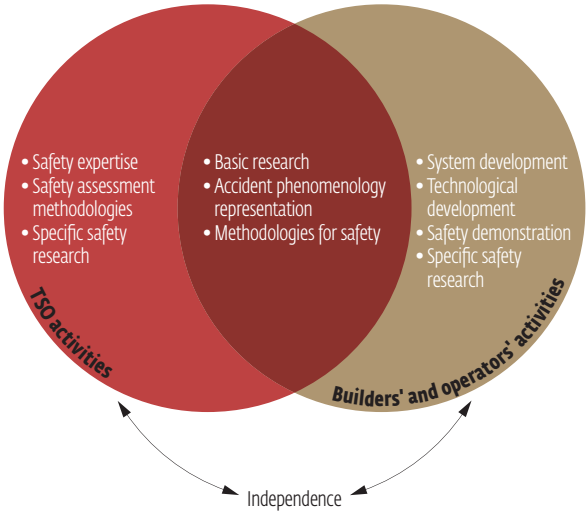
Skills development – an absolute necessity for bodies in charge of nuclear safety, security and radiation protection – is a time-consuming activity. A quite efficient way for any organisation to increase and test its staff's level of competence is to network in all technical areas, including research, operating experience feedback and knowledge management. Networking also allows ETSON member TSOs to deliver services to foreign governments in need of capabilities, in addition to the support they provide to their national public authorities, by participating in the establishment of an accessing country's regulatory authority.

To provide state-of-the-art technical support, ETSON member TSOs have developed common objectives, as explained by Édouard Scott de Martinville: "They are committed to being a forum for exchanges on safety analyses and R&D in the field of nuclear safety; to fostering

Inside view of a cooling tower of the Cattenom nuclear power plant located in north-eastern France.

R&D activities of TSOs and utilities

The diagram shows that common research between TSOs and utilities belongs to 'safety-oriented' research, i.e. accident phenomenology and assessment methodology. Such research allows cost optimisation through shared investments in common programmes while securing each stakeholder's independence through the possibility to perform in parallel one's own safety research.



the convergence of technical nuclear safety practices in Europe; to supporting the definition and implementation of research programmes; and to delivering expert services in the fields of nuclear safety, radiation protection and waste management, in both national and international frameworks."

Joint research is compatible with independent judgement

"ETSON member TSOs share research efforts with the other stakeholders in nuclear energy, but they safeguard their independence of judgement by separating safety assessment activities from safety demonstrations," Édouard Scott de Martinville points out.

As shown in the figure entitled 'R&D activities of TSOs and utilities', operators develop their specific safety research and safety demonstration on their own, whereas the TSOs also perform some independent research and develop their own safety assessment methodologies. "This guarantees the independence of each player in the field of safety, thereby contributing ultimately to greater reliability of assessments. It also allows TSO expertise to be focused on areas where a lot of work still has to be performed in order to improve scientific knowledge. Moreover, when the common research area is enlarged, there is room for high-quality scientific research projects likely to strengthen the consensus on safety," concludes Édouard Scott de Martinville.

... ETSON partners have their say

> Reaffirming the technical experts' role

"At the 2nd TSO conference in Tokyo, four years ago, ETSON chairman Jacques Repussard recalled that nuclear safety is science based and that research & development are therefore essential activities to enhance safety. The fundamental role of R&D is well understood at the IAEA and led in 2012 to the establishment of a forum aiming at an improved collaboration of technical and scientific experts from around the world. This Forum which is called TSOF is currently strongly involved in the preparation of the next TSO conference in Beijing, China, in October this year. Scanning the publications –Safety Standards, Safety Guides and other documents – released by the Agency's Department of Nuclear Safety and Security, reveals many highlights of the role and functions of technical experts. However, for the experts themselves – particularly in embarking countries –, it remains quite complicated to organise the work in the right way; and we all know that establishing the scientific and technical expertise in a country is a long process. Therefore, the IAEA's Department of Nuclear Energy has created a technical document called Technical Support for Nuclear Power Operations (IAEA-TECDOC 1078), first drafted back in 1999. The Agency offers to join and support the update of this technical document, thereby including both sides of the work of technical experts – for operators or for regulators – and to reflect the differences and potential conflicts. In line with this, the IAEA has a strong interest in the technical work of ETSON, in the Safety Assessment Guides for instance, which are an added value to the Agency's technical work that receives contributions from the OECD/NEA or the EC through the TSO Forum in which ETSON member TSOs form an important part."

Matthias Heitsch,
Senior Safety Officer, Safety and Security Coordination Section, IAEA

Learn more:

- *Main Benefits from 30 Years of Joint Projects in Nuclear Safety* http://oe.cd/AZ
- *NEA Annual Report – 2013* http://www.oecd-nea.org/pub/annual-report.html

> Raising awareness of ETSON

"The Nuclear Energy Agency of the Organisation for Economic Cooperation and Development (OECD/NEA) acknowledges the important role of the TSOs and maintains close collaboration with many of those which are ETSON members. There are regular exchanges of information and the work performed jointly produces good results. To increase ETSON's visibility, its representatives could be invited to make a presentation of the Network's activities at a meeting of the NEA Committee on the Safety of Nuclear Installations (CSNI), as many non-European CSNI members are not aware, for example, that ETSON has developed safety assessment guides under the leadership of Bel V, GRS and IRSN, or produced position papers pertaining to research on Generation II and III reactors and referring to NEA joint projects. Such a presentation might be a good way to raise awareness of ETSON and to harmonise the participation of its member TSOs in the CSNI's activities."

Kazuo Shimomura,
Deputy Director, Safety and Regulation OECD/NEA

> Strengthening the dialogue among the principal stakeholders

"Together with nuclear operators, radioactive waste management agencies and the research community at large, TSOs play a key role in the Euratom research and training programme on fission and radiation protection, which focuses on nuclear safety, including the safe management of radioactive waste. To further strengthen the dialogue among the principal stakeholders regarding research agendas and priorities, the European Commission promoted platforms such as SNETP and IG-DTP, while encouraging interaction with the wider S&T communities, notably through the European Strategic Energy Technology Plan. Such dialogue and cooperation is organised with due respect for the specific roles and responsibilities of the

Strengthening cooperation in the future

"The Nuclear Energy Agency of the Organisation for Economic Cooperation and Development (OECD/NEA) interacts with the TSOs mainly through its Committee on the Safety of Nuclear Installations (CSNI), where the head executives of many of ETSON's member TSOs are represented. So when ETSON was created, the cooperation framework was already well-established. Some leading countries in terms of safety research, such as France or Germany, whose TSOs were among the founders of ETSON, are actively supporting the NEA's joint projects alongside countries such as Japan and the USA. One of the key advantages of our joint projects is the multinational pooling of resources and expertise for research carried out at costly and complex facilities. Participation of additional ETSON member TSOs could further strengthen this cooperation in the future."

Javier Reig
Head of the Nuclear Safety Division, OECD/NEA

various actors, in order to ensure the necessary independence between demonstration and assessment of safety cases. The expected benefit to the Commission is professional guidance on the needs and priorities for research and innovation in nuclear safety, as well as streamlined and optimised dissemination of the results."*

Bruno Schmitz,
Head of Fission Energy Unit, Directorate General for Research and Innovation, European Commission

> A fruitful collaboration with ETSON

"In nuclear reactor safety, ETSON member TSOs are collaborating fruitfully with the Joint Research Centre of the European Commission (JRC) in three areas. The first is Operating Experience Feedback (OEF), where IRSN and GRS collaborate with JRC as part of the European Clearinghouse activities. These two TSOs have supported the Clearinghouse in developing a number of reports reviewing the current operating experience of France and Germany as regards certain topics of interest for the European nuclear regulatory authorities. These reports have been combined with JRC's own analyses of international operating experience so as to issue very extensive Clearinghouse topical studies. Concerning the improvement of severe accident assessment and management, collaboration has been on-going for more than two decades, first through the PHEBUS FP programme, which was initiated in 1988 through an agreement between IRSN (at that time IPSN) and the European Commission, represented by its Joint Research Centre, then through the Euratom 6th Framework Programme (FP6) SARNET (Severe Accident Research NETwork of excellence) project, followed by the Euratom FP7 SARNET2 project (2009-2013), both coordinated by IRSN. The collaboration with the JRC pertains to the development and validation of ASTEC, the European reference computer code for severe accidents developed by IRSN and GRS, and now continues through the JRC's active participation in CESAM (2013-2017), the Code for European Severe Accident Management developed under GRS coordination as part of the Euratom 7th Framework Programme (FP7). The third area of collaboration is the safety assessment of Gen IV reactors (SARGEN IV project) and in particular of the European Sustainable Nuclear Industrial Initiative (ESNII) demonstrator and prototypes, as well as the FP7 JASMIN project devoted to the development of the severe accident code ASTEC-Na as the European reference code for fast reactors. Future joint activities include the creation of a European Sodium-cooled Fast Reactor (SFR) database on severe accidents."

Michel R. Bièth,
Head of Nuclear Reactor Safety Assesment Unit, DG JRC, Institute for Energy & Transport

*All views expressed herein are entirely of the author, do not reflect the position of the European Institutions or bodies and do not, in any way, engage any of them.

... TSO activities and induced characteristics





TSO activities	Nuclear safety research programmes	Safety assessment methodologies and activities	Competence development	Work together in safety research projects	Perform safety assessment projects in dedicated consortia
Within ETSON	ETSON position paper on research to be performed for Gen II & III reactors	Development of SAG/TSAG Mutual support among members for safety expertise	Develop ENSTTI's building experience through the Junior Staff Programme	ETSON Research Group	Have a values charter and make sure it is implemented at all levels of the organisation PING group
In cooperation with all stakeholders	Participation in Strategic Research Agendas within SNETP as well as in the NUGENIA, MELODI, ALLIANCE and NERIS platforms	Foster dialogue between the European TSO Network and WENRA as well as other international organisations such as the IAEA and OECD/NEA	Participate in IRRS Offer ENSTTI possibilities beyond Europe	Develop research projects such as SARNET, ASAMPSA II, PASSAM, PRISME, DOREMI, SITEX, COMET...	Develop Riskaudit activities since 1992
Consequences in terms of TSO characteristics	Develop a European scientific and technical network in the nuclear safety field ETSON partners share research efforts with all the other stakeholders in safety, security, radiation protection and waste management	Participate in the EC's INSC programme to foster safety in neighbouring countries ETSON partners share operating experience feedback with all other stakeholders	Maintain an adequate training and knowledge management programme for the TSO staff Make systematic use of experience feedback for safety improvement	Maintain internal R&D programmes and studies allowing the development of new knowledge and techniques in support of its missions, and independence of judgement from licensees	Code of ethics: if a TSO delivers services to a foreign licensee, it does so in full transparency with respect to the licensee's nuclear safety authority, and is able to demonstrate that conflicts of interest are avoided

3 questions to...

Denis Flory

on the IAEA's expectations regarding TSOs

Denis Flory is the IAEA Deputy Director General and Head of the Department of Nuclear Safety & Security. Formerly International Relations Director of IRSN, he was instrumental in creating ETSON, the European Technical Safety Organisations Network, and ENSTTI, the European Nuclear Safety Training & Tutoring Institute.

What does the IAEA expect from TSOs?

I am deeply convinced that nuclear safety is not an administrative issue; it is a technical and scientific issue. The TSOs have a crucial role to play in enhancing nuclear safety. This is also true of nuclear security, as became obvious at the International Conference on Challenges Faced by TSOs in 2010 in Tokyo. The TSOs must draw lessons from the Fukushima accident to strengthen nuclear power plant safety and the decision-making capabilities of plant operators. Their work in three areas is important: safety assessment against high safety standards, emergency preparedness and capacity building.

The TSOs are strengthening collaboration among member states, including countries that are expanding or embarking on a nuclear programme, taking into account lessons learned from Fukushima. It is by networking, by sharing scientific and technical information among all TSOs, that our common goal of enhanced nuclear safety can be achieved.

Can you give some examples of cooperation between the IAEA and TSOs?

Following the Tokyo 2010 TSO Conference, we created a TSO Forum in 2011. Today, the Forum is contributing to the implementation of the IAEA Action Plan on Nuclear Safety. I can cite for example their efforts to strengthen emergency preparedness and response (EPR) and to effectively utilise research and development.

In the case of EPR, the Action Plan explicitly expanded the Agency's role of providing information during a nuclear emergency on its potential consequences, including prognoses of possible scenarios based on evidence, scientific knowledge and the capabilities of member states. We cannot perform such tasks alone; TSOs are the specialised bodies that can and do work with us to develop such prognosis capabilities. As an example, bilateral agreements have been signed with several TSOs to share accident modelling expertise.

An illustration of how the TSO network is useful to an embarking country is the United Arab Emirates, whose Federal Authority for Nuclear Regulation (FANR) needed the support of TSOs from around the world to license its first nuclear power plant, Barakah.

But TSOs also assist countries without a nuclear programme: in the aftermath of Fukushima, the Agency received many questions from countries without nuclear power plants needing to know how to react in case of an accident. The TSOs provided the Agency with valuable support in sharing their experience with these countries.

What about capacity-building?

Capacity-building is a concern for all. In an ideal world, embarking countries would have built up their own capacity before licensing, before an incident or accident. Non-nuclear-power states also need to have some technical capacity, if only to organise their response in case of an accident in their vicinity. Capacity-building is a key area for continuous improvement in nuclear safety. Education and training are core components of any capacity-building effort. An example is ENSTTI, the European Nuclear Safety Tutoring & Training Institute, which is important to the IAEA in this area. ✖

Becoming a capable TSO: **an ETSON view**

Engaging a country on the road to nuclear energy is a long-term project that has consequences for at least a century. What does it take a TSO in terms of principles, values, skills, resources and time to become a capable TSO? Top executives from five ETSON member TSOs debate the issue.

How to guarantee the independence of assessment and judgement, regardless of the chosen model, separate or integrated?

Benoît de Boeck (Bel V). In what I usually call 'nuclear countries', the structure adopted for the regulation of nuclear installations can be of two kinds: either a separate nuclear regulatory authority (NRA) and technical safety organisation (TSO), or an NRA where the TSO function is integrated. In most countries, the choice between these two options has historical reasons. However, having two separate organisations has several advantages, as the statutes of each organisation may be defined with a view to giving the NRA strength and stability, and to giving the TSO flexibility and autonomy. An independent TSO has a strong motivation to continuously improve its technical expertise, since it has to demonstrate its added value.

Frank-Peter Weiss (GRS). As you said, Benoît, the choice between a separate or integrated model has historical reasons. Therefore, it is essential in the case of an accessing country, for instance, to clearly understand the reasons for the differences in other countries, such as the traditional distribution of responsibilities between stakeholders. This will help the accessing country set up an appropriate organisational model and make use of good and bad experiences in different countries as regards decision-making, the structure of responsibilities, the rules of interaction between the stakeholders, etc. In this respect, I think international cooperation is necessary for insight into national organisations and working principles in other countries and to define one's own practices.

Jacques Repussard (IRSN). I share this view and I think there is ample guidance, in particular from the IAEA, as regards the roadmap for

setting up a nuclear regulatory system in a country which has decided to implement nuclear power technology. I think the nuclear regulatory system must be defined with a view to being independent of the energy policy guiding the development of nuclear energy. It should be able to convey its positions on nuclear safety matters at the highest level of the country's government and to ensure access to high-level scientific expertise to prepare its technical positions and decisions.

Eugenijus Uškuras (LEI). Absolutely! Nuclear safety is science-based and this is the reason why any TSO should aim to develop and maintain a high level of scientific and technical competence so as to express technical judgement independently of any external interests. As a TSO, the Lithuanian Energy Institute, for instance, has set up expert groups in the most important areas related to safety analysis: thermal hydraulics in reactor cooling and containment systems, neutron kinetics, structural integrity, probabilistic safety analysis, etc. Building up such expertise obviously takes time...

What are the prerequisites to develop a regulatory framework well adapted to national needs?

Ihor Shevchenko (SSTC NRS). I think the choice of a particular organisational model as well as the prioritisation of research and skill-building areas should be derived from each country's nuclear safety context. In Ukraine, for instance, the Chernobyl heritage has influenced the organisational model of SSTC NRS to a certain extent, especially in the radiation protection, decommissioning and radioactive waste management areas.

Nuclear safety requires a clear policy, and the resolve to stick to its implementation.

Eugenijus Uškuras (LEI). To develop a regulatory framework well adapted to national needs, I think it is not sufficient to implement existing guidance. ***You have to take advantage of others' experience and to take into account the national policy and priorities of your own country.*** In Lithuania, for example, the regulatory frameworks of Finland and Sweden as well as the IAEA Standards and Guides were carefully analysed to become the foundation on which our own regulatory framework was developed.

Ihor Shevchenko (SSTC NRS). I agree with you, Eugenijus! At the initial stage, it is reasonable to use existing guidance – notably the IAEA standards, which combine the best international practices and quite comprehensive experience, or WENRA's publications – to form a basis for the national regulatory framework. But each country has its peculiarities, which implies further development of specific, detailed regulations. One important task of SSTC NRS as a TSO is to support SNRIU, the regulator, in rule-making. With this purpose, special working groups within both organisations coordinate their activities in the development, revision and reinforcement of regulations and their harmonisation with international practices.

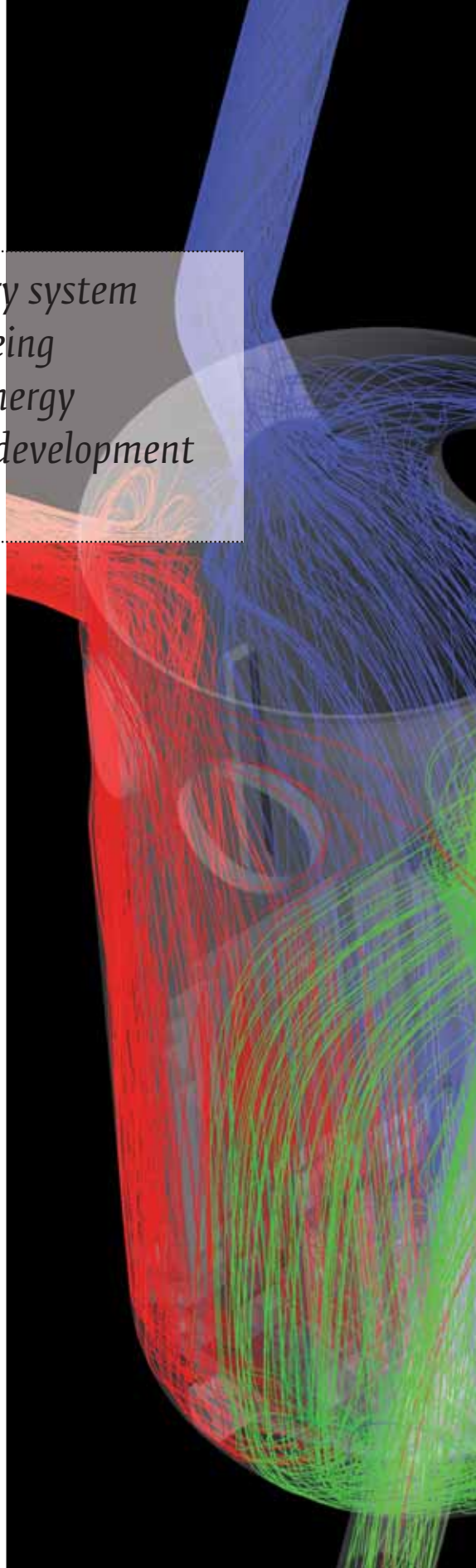
Why does the development of a capable TSO require a clear policy strategy as well as substantial time and money?

Jacques Repussard (IRSN). Paradoxically, the weakness of the existing guidance resides in its comprehensiveness, which may obscure the need for a clear policy strategy, understood and agreed at the highest level of government. In this regard, let me stress that developing one's own nuclear safety policy and a capable TSO to support it from a scientific and technical perspective necessarily takes time, in terms of budget appropriation, recruitment and training, development of fit-for-purpose equipment and tools, etc. Nuclear safety therefore requires a clear policy intention, and the resolve to stick to its implementation. Here also, cooperation with other countries is essential to achieving efficiency from the start. In the expert skills-building area for instance, ENSTTI has been set up to offer the 'hands on' approach that is indispensable to ensuring that the know-how of TSOs is based not only on theoretical knowledge but also on practical experience.

Frank-Peter Weiss (GRS). Perhaps the development of a capable TSO in an accessing country is achievable today in a reduced time span compared with many years ago, by making use of existing organisations and organising cooperation. ETSON is probably a good example of what can be done in this domain. Nevertheless, a major obstacle to fast-tracking the set-up of a capable TSO is the science-based nature of nuclear safety and the need for a TSO to develop effective interaction between knowledge, experience and capabilities. Subsequently, during a transition period, the regulator concerned could be advised by a foreign TSO in collaboration with the emerging national TSO.

Ihor Shevchenko (SSTC NRS). International assistance may significantly speed up this process by transferring knowledge and advanced experience. Nevertheless, ***the development of its own***

The nuclear regulatory system must be defined as being independent of the energy policy governing the development of nuclear energy.



capability should be the first priority for a TSO. For example, it took about seven years for SSTC NRS to become a capable TSO with international support. However, enhancing expertise and technical capabilities is a never-ending process for any TSO.

Benoît de Boeck (Bel V). It surely is! You might hire experts from outside the country, but you will have to carefully organise the transfer of knowledge from those experts to the national team in order to set up an independent technical expertise capability. So, in any case, ***building a strong safety culture takes time because it has to be based on experience.*** Now if I try to summarise the characteristics to be developed to become a capable TSO, I think that you have to start by establishing a clear role and mission within the national regulatory context that involves providing continuous technical support to the national nuclear safety authority, a global regulatory vision and a broad scope. Then you have to achieve and maintain scientific and technical independence and autonomy to express credible technical judgement. You will need reliable financing, preferably diversified in order not to be dependent on a single source. And most importantly, becoming a TSO requires strong ethical values such as honesty, trustworthiness and respect for stakeholders.

Which are the characteristics of a capable and competent Technical Safety Organisation?

Frank-Peter Weiss (GRS). The ETSON member TSOs have compiled the major characteristics of a competent TSO in a charter and use them as acceptance criteria for any TSO wishing to join the Network, with a view to ensuring that

To set up an appropriate organisational model and make use of good and bad experiences in the different nuclear countries, it is essential to clearly understand the reasons for the differences in their approaches.

newcomers will be capable of efficiently contributing to the common work and to the further development of the Network. Those major characteristics are a holistic approach to safety assessments in accordance with the regulatory policy, the development and enhancement of high-level competence in safety assessment, building upon knowledge, expertise and long-standing experience, the maintenance of an adequate staff training and knowledge management programme, an R&D policy allowing the development of knowledge and techniques to support safety assessment, and the independence of judgement of licensees. Adding to this is financial independence with transparent funding so as to form and express technical judgements autonomously from external interests, avoidance of conflicts of interest, and last but not least, transparency and openness in interactions with stakeholders such as government, public authorities, designers and operators, the scientific community, international networks, and the general public media. ***I think any TSO in the process of being established can measure itself against these criteria and use them for its development.***

Jacques Repussard (IRSN). The most crucial point to me is the following: there are plenty of competent experts in technical areas of interest for risk analysis – fire experts, neutronics experts, etc. ***The added value of the TSO function is to ensure that these strands of specialised technical expertise are properly woven into assessments which effectively address nuclear safety objectives as a whole.*** At the end of the day, this is what determines the capability of a TSO and its national and international credibility.