

**INTERNATIONAL CONFERENCE ON CHALLENGES FACED BY TECHNICAL
AND SCIENTIFIC SUPPORT ORGANIZATIONS (TSOs) IN ENHANCING
NUCLEAR SAFETY AND SECURITY: STRENGTHENING COOPERATION AND
IMPROVING CAPABILITIES**

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President of the Conference

BACKGROUND TO THE CONFERENCE

The International Conference on Challenges Faced by Technical and Scientific Support Organizations (TSOs) in Enhancing Nuclear Safety and Security, held in Beijing, China, in October 2014, continued the tradition established by the two preceding conferences on this subject that were held, respectively, in Tokyo, Japan, in 2010, and in Aix-en-Provence, France, in 2007. Like these earlier conferences, the outcomes of this conference will play a vital part in the national and international efforts made to ensure the effectiveness of nuclear safety and security regulatory systems and will focus, in particular, on and ways to maintain and strengthen the actions of TSOs in supporting the enhancement of safety and security worldwide.

OBJECTIVES OF THE CONFERENCE

The objectives of this conference were to assess and review ways to further increase the effectiveness of TSOs, taking into account lessons learned from the Fukushima Daiichi accident. In particular, the conference:

- Discussed the role of research and development (R&D) in enhancing nuclear safety;
- Helped participants to understand the impact of the Fukushima Daiichi accident on TSOs and to extract lessons to be learned;
- Highlighted the role of TSOs in the implementation of the IAEA Action Plan on Nuclear Safety;
- Provided a forum for discussion of the roles, functions and value of TSOs in enhancing nuclear and radiation safety and nuclear security, including through capacity building in those countries launching or expanding their nuclear power programmes;
- Facilitated the exchange of experience and good practices in planning and implementing cooperative activities for capacity building and in identifying needs for assistance activities from the standpoint of recipient countries;
- Considered appropriate approaches to enhancing cooperation and effective networking among TSOs and beyond, including the creation of centres of excellence;
- Provided an overview of the technical and scientific support needed to maintain a sustainable nuclear safety and security system;
- Fostered continued dialogue on all relevant technical, scientific, organizational and legal aspects at the international level.

OPENING SESSION

Mr. Li Ganjie, Vice Minister, Ministry of Environmental Protection, and Administrator of National Nuclear Safety Administration (NNSA) spoke of the phenomenal growth of nuclear power in China and the absolute need for scientific and technical innovation to assist it in developing its nuclear safety infrastructure and nuclear power programme, to meet its soaring demand for energy, protect the environment, and meet its national and international obligations to help mitigate global climate change. To this end, Vice Minister Li Ganjie provided details on the construction of a new national research and development compound for nuclear and radiation safety regulation, reinforcing technical support capacities in nuclear safety review, supervision, monitoring, emergency response, public communication and international cooperation. The phase I building area is 93 000 m², with a 750 million RMB investment; the total building area is close to 200 000 m². When completed, the compound will serve as a leading international platform for integrated and specialized technical support for nuclear safety regulation.

In addition, last year the funding for TSOs in China grew by 28% last year and the number of TSOs at the local, regional and national levels grew exponentially. Vice Minister Li Ganjie further stated that “Nuclear safety knows no boundary. Technical exchange shall have no barriers. The TSOs in China have paid full attention to studying and learning from the latest international standards on nuclear safety, and to improving China’s nuclear safety regulatory system and legislation and standards.” He further envisions that TSOs will soon be shouldered with more challenging work. He proposed that all countries should:

- Improve their verification, calculation, testing and validation capacity, and build up nuclear safety evaluation and review centres;
- Make greater efforts in R&D on nuclear safety technologies and build up nuclear safety technology R&D and application centres;
- Improve nuclear safety information technology and build up data collection and exchange centres;
- Establish sound human resource nurturing mechanisms and foster human resources ‘incubators’.

As NNSA celebrates 30 years of continuous improvement and growth in China, it will release a policy statement on nuclear safety culture describing eight features of nuclear safety culture. The policy statement will include a proposal for creating a sound nuclear safety culture across the entire industry, calling for all countries to contribute to improving nuclear safety and to put forward their own formal statement on safety culture.

Mr. Denis Flory, Deputy Director General, Head of the Department of Nuclear Safety and Security, IAEA, detailed the conference objectives, indicating that one of the main challenges facing the nuclear community today is the shortage of specialists with the competencies necessary for ensuring nuclear safety. In addition, he stated that TSOs increasingly provide crucial support for countries expanding and embarking on nuclear power, and that they increasingly work across borders, providing crucial assistance to regulatory bodies in places with fewer resources. He further emphasized that it was necessary to clarify expectations of TSOs in these circumstances, and that countries using an external TSO must have the in-house competencies to review the TSO’s work (i.e. they must be ‘intelligent customers’). Mr. Flory also underscored that many of the safety assessment actions undertaken after the Fukushima Daiichi accident have relied on close cooperation between the IAEA and TSOs. TSOs are now also involved in nuclear security through the

Global Nuclear Safety and Security Network (GNSSN). All stakeholders benefit from the comprehensive information available from TSO networks such as the IAEA TSO Forum and ETSON.

Mr. Benoît De Boeck, President of the Conference and General Manager of BEL V, Belgium, stated that TSOs provided valuable support to governments during the Fukushima Daiichi accident, such as explaining to the public what happened, what could happen and how their own country could be affected; they also recommended improvements to ensure that such an event would be less likely in the future. Mr. De Boeck also emphasized that TSOs provide independent, science based views that enable regulatory bodies to do their work. Therefore, TSOs play an important role in the emerging concept of ‘institutional defence in depth’. With regard to protection against extreme events, TSOs contribute to taking a balanced view of assessing risk (external versus internal).

KEYNOTE SPEECHES

Mr. Jacques Repussard, Director General of the Institut de Radioprotection et de Sûreté Nucléaire (IRSN), who served as President of the TSO Conference held in 2010 in Tokyo, Japan, provided a progress update on the recommendations made during the 2010 conference. He recalled the first key conclusion of the 2010 Conference, which recognized the two key pillars of a sustainable effective regulatory system: the ‘authoritative function’ and the scientific functions or ‘TSO functions’. He indicated that the progress over the past four years has been mixed: while we have succeeded in establishing a TSO Forum, organizing a third TSO Conference, and achieving progress in greater technical synergy between safety and security, progress must still be made in drafting the proposed IAEA Safety Guide on TSOs. He also suggested that the IAEA consider prioritizing the drafting of such a Guide. Because nuclear safety is science based, TSOs have a special role to play in addressing the safety challenges facing the nuclear community. TSO functions are part of each step of a holistic approach to nuclear safety. Guidance from international organizations such as the IAEA is needed in this regard. Recognition of TSO functions has progressed at the IAEA and worldwide (e.g. European directive); progress is still needed, including in Agency work and documents. Scientific and technical capabilities are progressing but still need to be reinforced, and the support provided by TSOs is essential for embarking/emerging countries. The science based work in TSO functions requires research to develop the science and knowledge base. In addition, there is a need for worldwide harmonization of nuclear safety practices to meet the highest standards. Regional and international networks enhance the work of TSOs, and peer reviews -- e.g. as part of IRRS missions -- can play an important role in this regard. Assistance to newcomers is a key part of harmonization needs. Mr. Repussard ended his keynote address by highlighting the vital role of communication, stating that the public and other stakeholders must be provided with science based information, as societal vigilance is essential to nuclear safety.

Mr. Gustavo Caruso, Special Coordinator for the IAEA Action Plan on Nuclear Safety, stated that approximately 70% of the nearly 800 tasks in the IAEA Action Plan on Nuclear Safety have been completed. Among the tasks where TSOs provided key support were the safety assessments (stress tests); IAEA peer reviews; the extension of capabilities in RANET; the review of IAEA safety standards; and harmonization of the liability regime within the international legal framework. He further emphasized that open and transparent communication is crucial; to that point, the IAEA is taking a leading role in putting together the forthcoming Fukushima report. The report will be a factual evaluation and assessment of

the accident comprising a summary report, written to be understandable to laypersons, and five scientific/technical chapters. Finally, he emphasized that not all the lessons learned from the accident at the Fukushima Daiichi nuclear power plant were new lessons and stressed that, when moving forward, steps need to be taken to ensure that past lessons ‘stay learned’.

M. Hirano, Japan Director General for Regulatory Standard and Research, Nuclear Regulatory Authority (NRA) provided a summary of activities in Japan related to the Fukushima Daiichi accident, including details of the development of new regulatory requirements by the NRA, effective as of July 2013. In addition, he stated that a total of 20 nuclear power plants have applied for a conformance review for restart. He recalled that the Japanese Diet report had concluded that the lack of expertise was one of the fundamental causes of the Fukushima accident, further stating that ‘technical independence’ is an essential element of an effective nuclear regulator, along with political independence and financial independence. In this context, on 1 March 2014, JNES was merged into the NRA to enhance the latter’s technical competence and expertise. At the same time, a new department was created in the NRA to serve as an ‘internal TSO’. In parallel, cooperation with the Nuclear Safety Research Center in JAEA and NIRS (National Institute for Radiological Sciences), which are the ‘external TSOs’, has been strengthened.

Regarding Fukushima Daiichi, TEPCO has been conducting various activities according to the Mid-and-Long-Term Roadmap towards Decommissioning under the supervision of the Government’s Council for Decommissioning. TEPCO has already completed more than 75% of the fuel removal from the spent fuel pool at Unit 4. The large amount of radioactive water being generated daily is a difficult issue that will need to be addressed through long term efforts. The highly radioactive water remaining in the seawater pipe trenches in the seaside area is currently the highest contributor to risk. TEPCO is attempting to plug the flow paths between the trenches and turbine buildings by applying an ice plugging technique, which will also be applied for the ‘frozen soil wall’ surrounding Units 1 to 4.

OVERVIEW OF TOPICAL ISSUE SESSIONS

Topical Issue 1: The Role of TSOs in relation to the Fukushima Daiichi Accident

The session presented the TSO challenges and solutions in response to the Fukushima Daiichi accident, TSO involvement in the implementation of stress tests, formulation and implementation of nuclear safety regulations, responses to the IAEA Action Plan on Nuclear Safety and work in post-accident recovery. Seven presentations were made by China, Japan, Germany, the Russian Federation, Slovenia, and the United Kingdom.

Topical Issue 2: Interface Issues

The session presented a wide array of interface challenges and issues that TSOs face when interacting with the regulatory body, industry and the public, as well as safety and security issues, during both non-emergency and emergency situations. Six presentations were made by France, the Republic of Korea, Finland, the Russian Federation, the IAEA and WANO.

Topical Issue 3: Emergency Preparedness and Response (EPR)

The session discussed the roles and challenges to TSOs in terms of emergency preparedness and response, assessment, prognosis and monitoring, as well as the regulatory and legislative frameworks in some countries that protect the TSO experts during response. Seven presentations were made by Canada, China, France, the Republic of Korea, Morocco, Ukraine and the IAEA.

Topical Issue 4: Maintaining and Strengthening TSO Capabilities

The session presented the challenges TSOs face in maintaining professional expertise, building capacity, and understanding the human and organizational factors that can affect them. Seven presentations were made by Belgium, Canada, China, France, USA and the IAEA.

Topical Issue 5: Networking among TSOs and beyond

The session presented the issues and challenges that TSOs face, as well as the benefits they derive when networking in a global environment. Six presentations were made by the Czech Republic, Lithuania, EU/EC-JRC, FORO, IAEA and OECD/NEA.

CLOSING SESSION

Panel Discussion: Future Developments, Vision of Future Cooperation among TSOs

CONCLUSIONS

- 1. While much progress has been made — especially since the accident at the Fukushima Daiichi nuclear power plant in March of 2011 — the lessons learned during this TSO conference, much like some of the lessons learned from the Fukushima Daiichi accident, are not new. TSOs continue face the same ongoing challenges. However, the need to face these challenges has never been more important than it is today, and will continue to be so in the future. This is equally true for countries embarking on new nuclear power programmes, for countries with existing power reactors that are facing long term operation issues, and for countries that have decided to phase out nuclear power and are facing the associated tasks.**

Like the first International Conference on the Challenges Faced by Technical and Scientific Support Organizations in Enhancing Nuclear Safety, held in 2007 in Aix-en-Provence, France, and the second, held in 2010 in Tokyo, Japan, this conference recognized that providing TSO experts from different countries and other organizations with an opportunity to meet to discuss and develop a common understanding of their responsibilities, needs, risks and opportunities is one of the few mechanisms available for paving the way forward. TSO leaders and other stakeholders concluded that a fourth conference dedicated to these issues was needed, to be held in three or four years.

Recommendation 1: The IAEA should consider initiating plans for a fourth international conference on TSO functions, science and expertise. In this respect, the conference welcomed the proposal of Belgium to host the next TSO conference.

- 2. Both the development and the implementation of nuclear regulations are, and must be, science based. Decisions made by regulators with regard to nuclear safety and security are complex and require a thorough understanding of the science and technology underlying the radiation and nuclear activities being regulated. Regulators must have at their disposal a body of independent technical and scientific safety and security experts and advisors to support their primary development and the implementation of regulations.**

There was general agreement that the regulatory body must: (1) **maintain its authoritative**

function, in relation to nuclear facilities and other licensed activities involving radioactive substances, **by having permanent access** to a competent and sustainable technical and scientific advisory expert function; (2) **provide for the continuing education, capacity building and knowledge sharing needs** of these experts so that they may continue to provide competent advisory services to the regulator in a timely manner; and (3) **recognize that the true costs associated with poor safety** extend far beyond the money saved in cutting funding to R&D programmes, and that those incisions—in reality cut into the marrow of the very framework that nuclear safety and security is based upon.

It was further noted that, for countries with newly developed nuclear workforces and those with ageing workforces, there is a need for capacity building, mentoring, training and education to ensure nuclear safety and security, and to maintain a strong safety culture.

3. There was strong consensus on the need to manage the interface between the TSO and stakeholders, the TSO and the regulator, and the TSO and industry — whether those experts are situated within the organizations they provide services to or are external to them.

The conference recognized that TSOs have a responsibility to contribute to addressing public and societal expectations with respect to communication to and involvement of the public, including providing the public with access to expertise. This is important to increase public confidence, especially as the public generally gives more confidence to experts than to many other actors.

The conference stressed that TSOs should give more attention to conducting research aimed at ensuring the safety and security of existing and future facilities and activities. Common research projects should be developed among different kinds of TSOs, using existing frameworks and research networks to the extent possible. There were also discussions on understanding and managing the interfaces between safety and security at all levels.

4. The role of TSO functions: A critical component of regulatory systems.

The previous conference recognized that regulatory systems comprise three major functions: the regulatory body authoritative function, the technical and scientific expertise function and of developing knowledge base and associated tool. The last two constitute the ‘TSO functions’.

The conference reaffirmed the fundamental role of science and technology in regulating nuclear activities. It recognized that, nuclear activities being of a high-tech and complex nature, scientific and technical expertise in nuclear safety, security and radiation protection is the foundation for their assessment and regulation.

This requires for the TSO functions a strong science and knowledge base, an integrated approach to assessment, and technical expert judgment

All of these elements are included in the IAEA Safety requirements **addressing safety technical issues, as a cross-cutting reference.**

5. The IAEA as a driving force: There is a critical need for guidance on TSO functions to support and enhance regulatory control.

There are large differences between countries with respect to technical approaches to performing TSO functions; it is therefore necessary to strengthen the safety and security

framework through the scientific and technical expertise that supports it. Guidance from the IAEA is critical in this regard.

TSO functions require the following elements: a strong science and knowledge base, an integrated approach to assessment, and technical expert judgment. These elements are referred to in several IAEA Safety Requirements; however, there is a need to address them in a Specific Safety Guide.

As noted at this and the 2010 TSO conference, the safety requirements that address TSO functions are not presented as a cross-cutting reference in a single, comprehensive Safety Guide, nor are they covered in an effective manner across the body of Safety Guides. The conference reiterated the need for such a guide to be developed.

Doing so would provide multiple benefits to those countries that already have nuclear programmes as well as to newcomers.

Recommendation 2: There was general agreement that the IAEA should produce a Safety Guide on the performance of TSO functions as part of the IAEA Safety Standards Series.

6. Peer reviews are recognized as a key means of enhancing safety and security. It would make it possible to better cover TSO functions in peer review missions, such as IRRS missions, in order to allow Member States to benchmark and improve their capabilities.

The IRRS peer review service covers extensively regulatory and organizational aspects of regulatory systems, but do not address in a thorough manner technical aspects. This is due in part to the absence of adequate standard in this field in the Agency safety standards. If such references were available in a safety guide, it would allow to adequately cover TSO functions in IRRS missions, in order to allow Member States to benchmark and improve their capabilities.

Recommendation 3: The IAEA should include within the IRRS, or other peer review missions, an evaluation of the capabilities of national TSO functions that underlie contributions to research, training and education, and the performance of safety assessments. It should also consider establishing specific missions or modules within existing missions to that effect.

7. TSO needs and functions are particularly crucial for newcomers.

There was strong consensus on the need for newcomer countries, countries with expanding nuclear energy programmes and those phasing out their nuclear energy programmes to create, develop or maintain their scientific, safety and security capacities. As new regulatory authorities are being established, their need for support is growing. TSO functions are instrumental in helping to ensure the establishment of the necessary scientific and technical safety and security knowledge and capacity, which is an integral part of the regulatory processes. Yet, progress in this area has been limited since the 2010 conference.

Recommendation 4: There was general agreement that the IAEA should fully integrate the work of the TSO Forum to better support newcomer countries, as a valuable means to contribute to building their capabilities.

8. Special efforts are needed to further develop and maintain the knowledge and competence base.

Effective nuclear safety and security supervision requires access to state of the art assessment capabilities. Such capabilities require scientific and technical knowledge in the nuclear field, together with sufficient assessment experience and proper management of knowledge and know-how. They also require maintaining advanced technical infrastructures, such as experimental facilities and computer codes, which can be shared among TSOs so that they can pool resources and avoid duplication.

They must be continuously developed, in a sustainable manner, at the national, regional and international level through:

- Scientific, risk oriented research;
- Relevant operating experience analysis, which is key to building the knowledge and expertise database;
- Knowledge management, dissemination and transfer to new generations of experts;
- Professional training courses and tutoring.

In particular, R&D is indispensable in creating and developing the safety and security knowledge and expertise required for the assessment of existing and future facilities. There still exist knowledge gaps that require research, especially in view of the continuous development of nuclear technology, and this undermines the credibility of regulatory assessments.

Recommendation 5: Common nuclear safety research projects should be developed among organizations carrying out TSO functions (1) using existing frameworks to the possible extent, in particular those provided by the IAEA and the OECD/NEA, and (2) through other efficient means, such as by creating or joining regional TSO networks.

9. The existing knowledge and capabilities of Member States are not sufficiently reflected in the combined IAEA Secretariat and Member State emergency response capabilities.

In this respect, the conference concluded that TSOs should offer their capabilities to be registered in the IAEA Response and Assistance network (RANET).

Recommendation 6: TSO s should make every effort to coordinate with the authorities in their countries in order to register their capabilities within the IAEA Response and Assistance Network (RANET).

Recommendation 7: The IAEA should further integrate TSO expertise to enhance the capabilities for assessment and prognosis during nuclear and radiological emergencies.

10. There is a widely shared concern that developing and maintaining TSO capacities is not always (or may not be in the future) adequately resourced.

Ensuring long term planning and funding is critical to the effectiveness and sustainability of TSO functions. TSO functions must have competent expert and adequate resources, and there is concern that this situation is not ensured to the same degree in all countries.

The conference pointed out that organizations performing TSO functions must have the resources to maintain independence of judgement while also achieving the highest level of technical competence and transparency. They should thus be able to provide independent technical and scientific advice without pressure from regulatory bodies, industry or other stakeholders.

Recommendation 8: Member States should ensure that adequate and sustainable resources are available to maintain the TSO capacity.

11. The IAEA Action Plan on Nuclear Safety has created momentum among Member States, and the TSO Forum must be a driving force for continued support.

The conference highlighted several positive examples of results achieved by the TSO Forum. There was general agreement that international cooperation and networking among TSOs is crucial to their capability. It contributes to increasing experience feedback, and provides the experience and the information base needed to tackle new cases.

The conference recognized that the IAEA, through the TSO Forum, is a strong driving force for the development of TSO functions and capabilities.

Recommendation 9: The IAEA should further expand the activities of the TSO Forum, to develop it into a science and expertise forum providing comprehensive coverage of issues concerning TSO functions in nuclear regulation. It should also expand its effort and establish—in particular new means for improved international networking to share knowledge and experience on technical and scientific practices.