Title: Meeting the challenge of the safety-security interface: IAEA’s role in supporting the enhancement of technical competence and support for nuclear security within Technical Support Organizations.

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*ABSTRACT:*

*Nuclear security and nuclear safety have in common the aim of protecting persons, property, society and the environment, in the case of safety from the harmful consequences of ionising radiation and in the case of nuclear security from the harmful consequences of a nuclear security event. Establishment of effective nuclear security measures require an understanding of the interface between safety and security measures and an awareness of the need to optimise the effectiveness of each.*

*Nuclear security requires a State to focus on prevention of, detection of and response to criminal and intentional unauthorised acts directed at or involving nuclear material, radioactive material, associated facilities and associated activities.*

*Nuclear security is a State responsibility and developing and implementing an effective national nuclear security infrastructure is a key requirement for every country and is built on a foundation of legal, regulatory, technical and administrative competence in nuclear security.*

*Appropriate management of the interface between safety and security results in both safety and security in a State being strengthened and enhances each State’s capacity to protect and secure its nuclear and other radioactive material, associated facilities and associated activities.*

*Traditionally many Technical Support Organizations have been focused on support for nuclear safety. However in many countries this has changed over time, particularly where a single regulatory body has responsibility for safety and security and has access to the services of a Technical Support Organization. The last international conference on Technical Support Organizations convened in Tokyo recommended that Technical Support Organization functions be extended to providing technical support to competent authorities in the field of nuclear security.*

*This paper will focus on the role of the IAEA in supporting, upon request, the development of technical competence in nuclear security in all States in order that the safety-security interface is appropriately managed and the capacities of technical support organisations be expanded to include nuclear security. This paper will examine a number of modalities for this support, including national and regional nuclear security support centres, collaborative knowledge networks, guidance and training.*

Introduction

It is widely accepted that the peaceful use of nuclear technology has the capacity to enhance citizen’s lives in many areas including access to a reliable supply of electricity for households and industries, diagnosis and treatment of illness and widespread application of radioactive sources in many industries, all of which benefit economies and ultimately societies. It is also widely accepted that the peaceful use of nuclear technology is only possible if full attention is given to the key issues of safety, security, radiation protection, waste management and emergency preparedness and response, to highlight a few. The management of these issues by a country requires access to appropriate legal, administrative, technical and scientific expertise in order to have appropriate and sustainable national infrastructure for nuclear technology. The effectiveness of legal, institutional and regulatory infrastructure is inextricably tied to the availability of technical and scientific expertise as the latter contributes, for example, to the development technical regulations and supports evidence based regulatory decision making.

Role of Technical Support Organizations

Technical Support Organizations are one mechanism that a country may use to enhance its technical and scientific expertise when managing peaceful applications of nuclear technology and to support the national legal, institutional and regulatory infrastructure for safe, secure and sustainable deployment of nuclear technology.

The role of the TSO is commonly understood as a provider of scientific and technical expertise to support decision making in the areas of inter alia safety and security, through specialized expert assessment. An important feature of a TSO’s role is the maintenance of ‘state of the art’ understanding of the subjects upon which they provide advice. This in turn requires a strong foundation in research and development to ensure comprehensive understanding of new and emerging issues. Ideally the TSO has complete independence from the “clients” to whom they provide their advice.

The importance of a national capacity to keep abreast of developments in technology and the impact on institutional responsibilities and capacities is underscored by the following example given in the context of a paper prepared and presented at the IAEA International Nuclear Security Conference in 2013. [[1]](#footnote-1)The author, Mr Richard Rosano of the United States, focused on the advent of new nuclear technologies, particularly small modular reactors (SMRs), and following a detailed consideration of their design features, he concluded that these developments necessitate that the traditional concept of nuclear security be reconsidered. In his paper he eloquently set out the challenges faced by regulators and operators when considering nuclear security in the context of these SMRs. He wrote:

At this moment the nuclear power industry is entering a new phase of power plant design and is at a crossroads with the advent of these alternative designs for nuclear power production. Traditional ideas about security should be challenged and avenues should be created for the altered security posture appropriate to small modular reactors to thrive. Given the opportunity, significant gains can be made in security efficiency, allowing departures from existing security standards at nuclear power production facilities to be implemented and revolutionize protection of the plants.

The states’ nuclear agencies can also take advantage of this evolution in design to think more creatively and recognize the unique nature of these new designs. The government agencies involved in, or regulating, the nuclear power industry may choose to develop specific sets of security expectations for each alternative design, including regulations and the guidance that supports them, and they should begin a dialogue to investigate more innovative security technologies to protect the plants…

The SMR community faces new burdens and new opportunities with the advent of the technology. The regulatory framework in countries with nuclear power generating facilities is well settled, as are the security perspectives and technologies which have evolved over years of experience and improvements. But the advent of the SMR designs presents the designers and utilities with the revolutionary prospect of altering their mindset on security and adopting a new set of strategies for the secure operation of the plant. This prospect also creates the unique opportunity for operators to make convincing arguments that the regulations could change to take advantage of the opportunities presented by this new approach.

Creative thinking “outside the box” by designers, operators, and regulators is required if financial savings and increases in effectiveness are to be realized. As noted earlier in this paper, security at nuclear facilities has been imposed in layered form over existing plants, and old security technologies have been allowed to dominate at a time when new, more efficient and more innovative technological advances could provide an opportunity to replace them.

The designers of SMRs and the utilities that intend to build the plants must invite the world of security experts to join in the planning process. The opportunity to use fresh ideas to design security into an incipient industry seldom presents itself. It is an opportunity that should not be lost.

TSO Functions related to nuclear security

Clearly the role of TSO’s is an important feature of new landscapes such as those that Mr Rosano describes and his paper explores many interesting issues related to these new designs and their impact on traditional security concepts. In the context of this conference the point can be made that TSOs can play an important role in assisting institutions including regulatory bodies think through the implications of new technologies and how the regulatory environment may need to be adapted to cope with the new environment. In this period of focus on new and emerging technologies it is important that a TSO can meet these challenges and perhaps also forecast the response that is needed to such developments, in particular in the context of safety and security and the interface between.

Previous TSO conferences in 2007 and 2010 focused respectively on the roles and responsibilities of TSOs and the importance of international cooperative activities and networking among TSOs to enhance nuclear safety and nuclear security, particularly in the context of the regulatory framework, including capacity building in those countries embarking on nuclear power programmes. The value of this conference is to take that dialogue a step further to tackle the challenges faced by a TSO in enhancing nuclear safety and nuclear security in the context of its national role.

Any number of situations may give rise to safety-security interface issues, such as changes in facility or activity conditions, procedural changes, process changes or installation of new items for example. The most important aspect of addressing nuclear safety-security interfaces is to establish management systems or procedures that allow for the identification of such interfaces and the development of solutions that satisfy the requirements of both safety and security. In considering the appropriate solution it should be kept in mind that nuclear safety and nuclear security are equally important and that any solution to the interface issues presented by the change needs to be acceptable within the requirements of both systems.[[2]](#footnote-2)

A major challenge confronting a country’s capacity to enhance safety and security is to ensure appropriate access to suitable number of experts, in particular to support nuclear security. The remainder of the paper will focus on the IAEA’s central role in coordinating international cooperation and assistance in nuclear security as well as its role in the support of each State’s development of nuclear security expertise and the contribution that the IAEA Nuclear Security Programme can play in supporting a country’s TSO in particular.

Functions of the IAEA in supporting technical and scientific expertise in nuclear security

Each State carries the full responsibility for nuclear security. Specifically each State has the responsibility to provide for security of nuclear material and other radioactive material and their associated facilities and activities; to ensure the security of material in use, storage or in transport; to combat illicit trafficking and the inadvertent movement of such material; and to be prepared to respond to a nuclear security event.[[3]](#footnote-3)

Through its nuclear security programme the IAEA supports States, upon request, to establish, maintain and sustain an effective nuclear security regime. The IAEA has a comprehensive approach to nuclear security that recognizes that a nuclear security regime is comprised of: the legislative and regulatory framework and administrative systems and measures to support nuclear security; the institutions and organizations within a State responsible for ensuring the implementation of the legislative and regulatory framework and administrative systems for nuclear security, including a TSO and the systems and measures for nuclear security as well.

Support for the regime must be underpinned by appropriate scientific and technical expertise. Three specific components of the Nuclear Security Programme of the IAEA that support the development of nuclear security expertise and can strengthen the development of the technical and scientific basis for nuclear security in a country will be discussed in the remainder of the paper.

Development of Nuclear Security Guidance documents

The Nuclear Security Series is a hierarchical set of guidance documents comprised of Nuclear Security Fundamentals[[4]](#footnote-4) that specify the objective and essential elements of a nuclear security regime; Recommendations documents[[5]](#footnote-5) that set out the measures that States should take to achieve and maintain an effective national nuclear security regime consistent with the Fundamentals; Implementing Guides[[6]](#footnote-6) that provide guidance on the means by which States could implement the measures set out in the Recommendations and Technical guidance publications on specific technical subjects to supplement the guidance in the implementing guides.

The Nuclear Security Series provide guidance for national experts on key issues that should be considered when providing advice for example to competent authorities with responsibilities for the regulatory functions of a State or to an authorized person seeking to comply with the State’s regulatory requirements in relation to nuclear security. The Nuclear Security Series is an important resource for an organization within a State, such as a TSO, so that a TSO is fully informed about the areas in which its expertise may be sought in relation to nuclear security related subjects.

Coordinated Research Projects

Coordinated research projects (CRPs) are an important mechanism for organizing international research work to achieve specific research objectives consistent with the IAEA’s programme of work, including the in area of nuclear security. CRPs bring together researchers in both developing and industrialized States to solve a problem of common interest. The mechanism allows and facilitates the involvement of Member state institutions in contributing to advancements in key disciplines within nuclear security. .The results of these projects are available free of charge to scientists, engineers, policy makers and other users from all of the Member States. A primary objective of a CRP is normally the formulation and preparation of a research project for specific application. Other objectives are often related to the availability of the developed results through the publication of technical documents or guidance contained detailed description of the subject and outcomes of the research.

A good example of a CRP that has been established in the context of nuclear security is one that was initiated in in December 2012. This CRP is the “Development of Nuclear Security Assessment Methodologies (NUSAM) for Regulated Facilities”.

The main objective of the NUSAM project is to establish a risk-informed, performance-based methodology for the assessment of physical protection measures for nuclear and other radioactive materials, as well as associated facilities and activities within regulatory control. A secondary objective is to provide an environment for the sharing and transfer of knowledge and experience, and to provide guidance on, and practical examples of good practice in assessing the security of nuclear and other radioactive materials, as well as associated facilities and activities.

The NUSAM project will produce practical examples of the application of the framework. The outcome will be well documented in a number of reports that include:

* Describe overall NUSAM methodological framework and each of its elements and the output from each of the working groups;
* Describe the models (i.e., description of the hypothetical facility/activity) that the security case studies will analyse; and
* Illustrate the application of the NUSAM methodological framework for the models developed above.

The expected outcomes of the CRP include:

* An enhanced risk-informed performance-based methodological framework for nuclear security assessments;
* Practical illustrations of the methodological framework’s application to a range of facilities and activities;
* An improved understanding of nuclear security assessment processes and their application in Member States;
* Identification of nuclear security areas (tools/methodologies) that are not currently adequately analysed; and
* Various reports and documentation of the above including output from the working groups documenting lessons learnt (i.e., what worked, what did not work or what was not considered).

A TSO will be advantaged by both participation in activities such as these as well as being able to utilise the outcomes of such CRPS in the further development of their understanding of nuclear security and their capacity to provide support to key State institutions.

Education and Training Programme

To help States address their national need for the development of a cadre of expert and competent nuclear security practitioners, including those engaged by TSOs, the IAEA has crafted a comprehensive human resource development strategy for nuclear security, which is implemented by the Division of Nuclear Security. The main part of this strategy is to assist States, upon request, to establish education and training programmes for nuclear security. The IAEA supports the strategy through a comprehensive training programme and through two international knowledge networks– the International Nuclear Security Education Network (INSEN), and the International Network for Nuclear Security Training and Support Centres (NSSC).[[7]](#footnote-7) These networks are both repositories and generators of new nuclear security expertise.

The International Nuclear Security Education Network (INSEN) was established in 2010 as a network of universities and other tertiary educational institutions to support the implementation at the national level of the IAEA Nuclear Security Series technical guidance document No. 12 “Educational Programme in Nuclear Security” that outlines, among other things, a comprehensive Master of Science curriculum in nuclear security. The mission of the Network is to promote, based on the IAEA Nuclear Security Series, excellence in nuclear security education, fostering the next generation of professionals who have the knowledge and expertise in nuclear security.

In 2012, the Agency helped establish the International Network for Nuclear Security Training and Support Centres (NSSC), comprised of institutions designated by each State to provide technical, scientific, human resource development and other capacity-building functions on the national and regional levels.

While the main objective of the INSEN and NSSC networks is the promotion of nuclear security human resource development via dedicated education, training and other supporting activities, both networks have operated as hubs of substantial and comprehensive expertise and knowledge on the entire range of nuclear security topics. Several activities that network members are engaged in support this function and contribute to knowledge growth and distribution.

For example, one of the prime activities of the INSEN network is the development and distribution to its members of thematic textbooks and packages of teaching material, based on the IAEA guidance documents and reflecting the academic curriculum outlined in the NSS 12 Educational Programme in Nuclear Security. So far, 15 sets of teaching materials and three textbooks have been completed, not only allowing academic instructors from a variety of universities and other institutions to teach these courses, but also capturing in them the latest information about the critical aspects of nuclear security.

In addition, professional development opportunities offered by a number of INSEN member to their peers have contributed to a considerable growth of expertise among the academic community in various aspects of nuclear security. A series of such professional development courses (PDCs) on the Introduction to Nuclear Security, and Computer Security for Nuclear Applications conducted in the course of last three years reached almost 200 faculty members from over 30 member states. In addition, a handbook for instructors on teaching nuclear security has been produced by INSEN members to assist academics with little experience in the subject. Finally, increasingly, the teaching materials originally available in English only are being translated into other languages, both official IAEA and local languages where such materials are needed most. Much of this activity is performed at the initiative of INSEN members with dedicated contributions from some member-states.

The activities of the NSSC network, which involves institutions with practical and technical expertise, contribute with equal importance to the development and sharing of knowledge in nuclear security. At the initiative of the NSSC network, both networks are engaged in a mapping project, which will create a database of all academic, training and nuclear security support institutions involved in both networks that would make available information to member-states about their capacity for human resource development, technical and scientific support, and other services that can contribute to the establishment and further development of national nuclear security regimes.. This exercise also allows for greater collaboration and information sharing between the two networks, which would make available the resources and opportunities of both networks to each other, enhancing their ability to provide their respective services to the fullest potential and to the benefit of their respective governments.

The knowledge and expertise generated and shared by the two networks and its individual members greatly enhance the scientific and technical underpinning of nuclear security within a State and in particular within those institutions within the State, including TSOs, with responsibility for supporting the nuclear security regime. Experts from INSEN and NSSC institutions are establishing viable and effective nuclear security regimes, and work tirelessly to promote good nuclear security culture among the current personnel at nuclear facilities worldwide as well as fostering the new generation of nuclear professionals committed and dedicated to the principles and goals of nuclear security.

Conclusion

Nuclear security and nuclear safety have in common the aim of protecting persons, property, society and the environment, in the case of safety from the harmful consequences of ionising radiation and in the case of nuclear security from the harmful consequences of a nuclear security event. Establishment of effective nuclear security measures require an understanding of the interface between safety and security measures and an awareness of the need to optimise the effectiveness of each.

Appropriate management of the interface between safety and security results in both safety and security in a State being strengthened and enhances each State’s capacity to protect and secure its nuclear and other radioactive material, associated facilities and associated activities.

Recognising the changed roles of Technical Support Organizations over time to an extended function of supporting both safety and security the IAEA has an important role to support, upon request, the development of technical competence in nuclear security in all States in order that the safety-security interface is appropriately managed and the capacities of technical support organisations be expanded to include nuclear security to enhance and strengthen both safety and security.

1. Richard P Rosano, Talisman International, Security for Alternative Nuclear Designs, IAEA International Nuclear Security Conference 2013 [↑](#footnote-ref-1)
2. Guidelines for drafting IAEA Safety Standards and Nuclear Security Series Publications July 2016 [↑](#footnote-ref-2)
3. INTERNATIONAL ATOMIC ENERGY AGENCY, Objective and Essential Elements of a State’s Nuclear Security Regime, Nuclear Security Fundamentals, Nuclear Security Series No. 20, IAEA, Vienna (2013). [↑](#footnote-ref-3)
4. Ibid [↑](#footnote-ref-4)
5. INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5), IAEA Nuclear Security Series No. 13, IAEA, Vienna (2011);INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Radioactive Material and Associated Facilities, IAEA Nuclear Security Series No. 14, IAEA, Vienna (2011); INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control, IAEA Nuclear Security Series No. 15, IAEA, Vienna (2011). [↑](#footnote-ref-5)
6. Some examples include: INTERNATIONAL ATOMIC ENERGY AGENCY, Implementing Guide on Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme , IAEA Nuclear Security Series No.19, IAEA, Vienna (2013); INTERNATIONAL ATOMIC ENERGY AGENCY, Implementing Guide, Development Use and Maintenance of the Design Basis Threat , IAEA Nuclear Security Series No.10, IAEA, Vienna (2009) [↑](#footnote-ref-6)
7. IAEA-TECDOC-1734, Establishing a National Nuclear Security Support Centre, <http://www-pub.iaea.org/MTCD/Publications/PDF/TE-1734_web.pdf>. [↑](#footnote-ref-7)