



TOWARDS AN EFFECTIVE ROLE OF TECHNICAL SUPPORT ORGANIZATIONS

Amaal A. Tawfik

Nuclear and Radiological Regulatory Authority, 3 Ahmed El zomorst., Nasr city, Cairo,
Egypt

Abstract

TSO is a technical and scientific support organization that provides support concerning nuclear and radiation safety issues to the regulatory body “regulator” or to the nuclear industry “operator” or to the stakeholders. Regulatory bodies (RB) are responsible for licensing nuclear installations, for issuing regulations and for supervising licensed facilities during their operation, with corresponding decision making and enforcement if needed. To perform its tasks, the RB can do everything itself, with in-house technical and scientific support. However, it is becoming difficult to have specialists in every field of nuclear technology to cover an ever increasing number of topics, including human and organizational aspects. Hence many RBs opt for outside technical and scientific support. For instance, in the licensing process, a TSO can provide support to RB at all stages of the process. The support of TSOs may be required in establish and develop regulations and guides, review and assessment, education and training, and, in some cases, inspection activities. In many countries, periodic safety reviews are required. For the initial safety assessment, the TSO can provide the RB with an evaluation of the actions proposed by the licensee and advise it concerning any additional measures required to maintain or improve the safety of the installation and update the licensing basis. Operational experience of the plant, and of similar plants worldwide, should also be investigated by the TSO, so that the RB can ask the licensee to identify preventive measures, avoid recurring events, and verify that lessons have been learned and modifications made have met their objectives. The TSO

activities in support of the nuclear industry (operators) cover some of the same areas as those in support of RBs. However, the emphasis is not only on the problems to be tackled, but also on proposals for solving them.

If a TSO provides support to both RB and an operator, that fact should be made known to all parties and the TSO should be required to demonstrate that there are no conflicts of interest. In this way, TSOs can gain public confidence and explain the technical bases on which decisions have been made. TSO should try to make the scientific information accessible to the non-specialist, while avoiding any oversimplification that might introduce misunderstandings and misconceptions.

This paper will focus onto technical and scientific knowledge of the TSO, areas of support, TSO for regulator, TSO for operator, TSO for stakeholders and requirements for the independence TSOs.

Key words: regulatory body, operators, stackholders, safety, technical and scientific support.

Introduction

The coherent and consistent set of fundamental safety principles ^[1] to achieve the fundamental safety objective, “To protect people and the environment from harmful effects of ionizing radiation”, includes the prime responsibility of a licensee for safety throughout the lifetime of its facilities and activities, and this responsibility cannot be delegated. In addition, the fundamental safety principles foresee governmental responsibility related to the authorization (or *not*) of licensees’ activities. Traditionally, the components of nuclear safety, which must be realized by a licensee and under constant regulatory focus, are divided into three general areas ^[2]:

—Human factors (sufficient properly qualified and trained personnel to operate the facility, to maintain the equipment, etc.);

—Technical components (facility is designed, constructed, tested, operated and maintained in accordance with the design and safety requirements);

—Organizational components (set of procedures on operation, testing and maintenance, systematic analysis of operating experience, safety assessments of all changes and corrective actions made, fuel and waste management, ageing management, accident management, security measures, etc.).

The provision of the necessary competence to the regulatory body differs from country to country. In some, sufficient competence is available within the regulatory body itself, and further technical support is provided by other independent organizations. This is referred to as

an integrated TSO model. Another approach is the external TSO model, where the TSO is specifically assigned to assist the regulatory body. In this model, both the TSO and the regulatory body require independent in-depth knowledge and high levels of competence in the relevant areas of nuclear operation and related research activities to provide technically correct insights and reactions to various regulatory requests and to define their research topics.

In the case of accidents, the TSO can advise the RB about the possible accident scenarios and emergency measures that might be necessary. Some TSOs have indeed developed computer codes to predict the radiological consequences of design basis accidents or more severe accidents. When a plant ceases its operations, the TSO can assess the decommissioning plan and monitor its implementation. For all these assessment activities made in support of the RB, while the TSO should clearly define what the problems are, it should refrain from proposing solutions to the licensees, who bear the complete responsibility for the safety of the licensed installations. In this way, the TSO maintains its freedom to assess the licensee's proposals. A last field of activity for the TSO in support of the RB is assistance in developing regulations. As TSOs are well aware of the practices on the shop floor, they are in a position to anticipate possible difficulties in the interpretation of regulations and influence the wording so as to avoid future implementation problems.

In all the fields mentioned above, the RB will be able to outsource the assessments to the TSO and integrate the results into its decision making and enforcement processes

The TSO:

- Must follow the regulatory framework of the country requesting the service;
- Must address internally any conflict with positions adopted by the national regulator;
- Cannot disseminate information to the public or publish it without permission;
- Cannot interact independently with licensees or their TSOs, if the TSO is that of the regulator

TSOs should follow two basic principles:

- (1) The expert opinions of the TSO must be independent.
- (2) If a TSO also provides services to a domestic or foreign licensee (utility or vendor), it has to do so in full transparency so that when providing services to a regulatory body it is able to demonstrate that conflicts of interest are excluded.

The first principle means that a TSO must be able to elaborate and express its technical assessment independently of any external interests, be they political or economic. They have to be absolutely resistant to any influences from the licensor or licensee. There should be a clear borderline between the technical assessment by the TSO and the legal evaluation by the regulator and the nuclear authority.

Technical and scientific knowledge of the TSO^[3]

As the main task of the TSO is to provide technical and scientific support in the decision making process of the RB or of the industry, its knowledge must be maintained at the highest level in all the fields of its expertise.

For TSOs that deal with very specific subjects — for example, university laboratories or dedicated departments of nuclear research centers — keeping abreast of the latest studies, discoveries and technological developments is an inherent part of their mission. Nowadays, collaboration between researchers has developed, for example in the R&D Framework Programme of the European Union.

For TSOs that perform global safety assessments for RBs or for the industry (the technical safety organizations), the development and maintenance of the technical and scientific knowledge base and paying attention to emerging concerns are much more difficult, as the scope is much larger. For this reason, it is necessary to prioritize topics according to their safety significance. An efficient way to obtain and keep this knowledge is to participate in international research programs (e.g. those sponsored by the IAEA, the OECD Nuclear Energy Agency (OECD/NEA) and the European Commission (EC)), where each participant makes its expertise available to all, while the costs are shared among all participants. Bilateral and multilateral collaborations are also possible, for example for the development of computer codes and their validation on experimental results. The Committee on the Safety of Nuclear Installations (CSNI) of the OECD/NEA has been very active in the launching of international research programs in quite a number of domains, including fuel behavior under

design basis accident conditions, severe accidents, thermal hydraulic experiments and computer codes benchmarking, fire propagation and reliability bases. Periodic safety reviews are intended to maintain or improve the safety of operating installations. They are also a way to maintain the knowledge about the installation, or to transfer it to younger people. An interval of ten years appears to be adequate for this purpose. Operating experience feedback and in-depth reviews of the applicability of lessons learned are also occasions to revisit the knowledge concerning an installation.

Area of Support

The areas of support include sitting assessments, design assessments, evaluations of operating experience and the development of different aspects of emergency preparedness. The issues of decommissioning and waste disposal are also taken into account. Technical and scientific support organizations support the regulatory authorities in the decision making process by providing technical advice in all these areas.

The TSOs must, therefore, have sufficient personnel and financial resources to perform safety related research that is not driven by current regulatory needs. The knowledge gained from this research ensures that the expertise requested by the regulator is based only on the most up to date science and technology, and is independent of current regulatory and political influence. Thus the independence of a TSO is a prerequisite for its long term support of regulatory decision making.

The need for licensing and safety assessments of such plants led to the creation of RBs, which often also became responsible for the licensing of the installations belonging to the atomic energy commissions, which up to that time had performed these tasks for their own installations. In this way, licensing activities became completely separated from the technological development and promotion of nuclear energy. Depending on the country, the responsibilities of the NRA can include both nuclear and radiation safety, or the two can be separated, with two coexisting regulatory authorities. As a support to the regulatory body, TSOs provide technical and scientific bases for the RB's decisions. They provide safety assessments and in some countries also inspect installations on behalf of the RB.

Challenge Faced Egyptian Regulatory Body

The challenge that Egyptian Nuclear and Radiological Regulatory Authority (ENRRA) is facing is that it has many responsibilities. One of these responsibilities include drafting regulatory documents for the NPP, nuclear safety oversight such as nuclear safety

assessment, inspection and enforcement, response to radiation and nuclear incidents, and implementation of Egyptian obligations in international treaties to which Egypt has acceded. As such, Egyptian regulatory body (ENRRA) needs qualified staff who are professionally trained in various disciplines.

Developing regulatory documents is another challenge where support from TSO is needed. It is expected that from now to 2026, there should be about 60 regulations for the NPP. And in total for the operation of the NPP, 110 regulations shall be issued. It is also expected that a number of staff will be needed in different areas — for example, in nuclear safety assessment and regulatory document development for the NPP — and regular responsibilities must also be fulfilled. And as in any nuclear entrant country, it is difficult to recruit new staff with the required qualifications.

TSO & Regulators^[4]

If the regulatory body is not entirely self-sufficient in all the technical or functional areas necessary to discharge its responsibilities for review and assessment or inspection, it shall seek advice or assistance, as appropriate, from consultants. Whoever may provide such advice or assistance (such as a dedicated support organization, universities or private consultants),

For the TSO, which is embedded in this system, the following working areas can be derived:

—*Rules and regulations*: TSOs support the regulator in the development of technical guidelines, in contributions to acts and ordinances concerning technical questions, and in developing and improving rules and regulations. To serve the regulator in this field, the TSO must have comprehensive knowledge of nuclear safety and its regulatory basis.

—*Licensing*: The support in licensing questions includes the licensing of both new nuclear installations and major back fits. An independent analysis of important safety issues is necessary, as is sound technical analysis of the licensee's assessments.

—*Operating experience feedback (OEF)*: The OEF is a fundamental source for the continuous improvement of nuclear safety, and thus an important field of competence for TSOs.

—*Inspection*: The confirmation of the licensing status of the plant is the main objective of inspection. The support of the TSO also includes determining how detailed and frequent the inspections will be, as well as reviewing safety assessments like the periodic safety review.

—*R&D*: The possibility of having competencies in the field of R&D is an important prerequisite for the independence of a TSO. A distinction can be made between basic R&D and regulatory oriented R&D. Basic R&D can be used to increase knowledge concerning important phenomena and to be aware of the state of the art of safety related research. Regulatory oriented R&D concerns activities in the field of current regulatory safety issues and includes the verification of the licensee's calculations. For both applications, a sound scientific basis and various numerical codes or code

TSO & Operators^[5]

The operator's responsibility is to show that a power plant and its operation meet the safety requirements. To establish proof of compliance with safety requirements, the operator might involve the manufacturer, the engineering companies or universities as TSOs. As a prerequisite for permission to operate a nuclear power plant, the operator has to be competent and prove its specialized knowledge; thus it has to have expertise concerning the various issues related to plant operation and safety. A TSO is usually utilized when additional human resources are needed or more detailed questions have to be answered. Quite often, a TSO will be involved when specialized knowledge or an independent view is needed or useful. In contrast to the requirements to be met by operators, there is neither a definition nor the need for formal proof of the regulator's competence. The consequence is that the competencies of the authorities vary widely from country to country. In some countries, the competencies are internalized in the authorities. In other countries, the authorities might not even be able to judge the results in accordance with the requirements. Here, the TSOs play a major role and take on a great responsibility.

As its contribution to the licensing process, the TSO can carry out the safety assessment of the project, identify the problem areas and indicate the best solutions. It can also help to prepare the commissioning tests, participate in them and evaluate the results. During operation, the TSO can identify/review modifications to facilitate plant operation, increase plant availability through a reduction of the outage time, prepare the periodic safety reviews, examine measures to extend the life of the installation and assess lessons learned from feedback of operational experience, both national and international. The TSO can even make

inspections of the installation during operation, if the operator desires some kind of external audit. When the RB intends to develop new regulations, the TSO can review the draft regulations and provide comments, reflecting the viewpoints of the operator so as to facilitate full compliance with the requirements. In the case of accidents, the TSO can try to develop different evolution scenarios, evaluate their possible radiological consequences and recommend appropriate countermeasures to the licensee.

TSO & Stakeholders^[6]

Technical and scientific support organizations provide the scientific basis for decisions made by either the RB or the industry. To maintain their credibility with respect to the other stakeholders and the public, the TSOs must observe a number of ethical codes. They must focus on the technical problems and their impact on safety, and express technical judgments independent of external interests, both political and economic. Among the qualities to be promoted are honesty, impartiality, proactiveness and initiative, consistency and proportionality in the safety approach, and respect to all stakeholders. If a TSO provides support to both RB and an operator, that fact should be made known to all parties and the TSO should be required to demonstrate that there are no conflicts of interest. In this way, TSOs can gain public confidence and explain the technical bases on which decisions have been made. They should try to make the scientific information accessible to the non-specialist, while avoiding any oversimplification that might introduce misunderstandings and misconceptions.

Requirements for the independence TSOs^[7,4]

Hence, similar to the requirements concerning the regulatory bodies, there are also requirements for the independence of TSOs. The technical advice of the TSO must be independent of any external influences as far as possible. This means that:

—TSOs must have an overall view of safety. This implies that the TSOs follow a long term strategy to develop methods and codes related to nuclear safety. Concentration solely on day to day regulatory business could hinder this continuous and necessary development process. Furthermore, this process builds up and maintains the knowledge of the TSO. Knowledge is necessary for independence. Independent knowledge is the only way to support the regulatory body in the long term.

—TSOs must develop their own assessment and evaluation processes. These processes ensure that a TSO need not follow the justifications of the operators, but can evaluate the safety implications of design measures or procedures based on its own expertise. TSOs must be independent of industrial developments and research.

—TSOs must be able to push the development of nuclear safety by defining their own research needs and their own research results, and by using the results and experiences of other organizations, including operators. The operational data acquired by the operators should be, to a large extent, open for the research needs of TSOs and vice versa. An important example is the use of data in preliminary safety assessments. Without TSOs, the development of this important tool, from the regulatory side as well as from the licensee side, would not have advanced so far. Probabilistic safety assessments (PSAs) can now be performed in the design stage of new reactors, without specific operational data, through verified application of the operation experiences and progressive mathematical methods. TSOs must be involved in the exchange of safety related insights.

—TSOs must cooperate with other TSOs, research centers, universities and specialized expert organizations. This collaboration is necessary, especially in those areas of competence that are not fully covered by the TSO. These areas may not be within the nuclear core areas of competence but may have an oblique influence on safety. TSOs must cooperate with other TSOs to complement their areas of competence.

—International cooperation between different TSOs and with international organizations such as the IAEA and OECD/NEA is indispensable for ensuring that the TSO competence is at the state of the art of science and technology. Continuous international benchmarking and the exchange of experiences and views are important measures for maintaining and developing competencies. This implies participation in the related working groups and meetings of the international organizations, as well as bilateral or multilateral cooperation. International cooperation is indispensable for maintaining competence. Independence is crucial where a TSO cooperates with the licensee. On the one hand, such cooperation is important for the TSO, as it enables it to remain up to date with respect to technical solutions and to obtain sound experience concerning operating issues and safety related questions. On the other hand, the TSO serves as a counterpart to the licensee in reviewing and assessing technical solutions. Therefore, a code of ethics is necessary when a TSO provides services to a domestic or foreign licensee. Full transparency is necessary with respect to the licensee's nuclear safety authority to demonstrate that conflicts of interest are avoided.

Conclusion

To support the regulatory body in an appropriate way and in accordance with the state of the art, it is necessary for TSOs to be independent of any external influence. Since the regulatory bodies have multiple responsibilities in regulating nuclear safety, it is the task of the TSO to provide its expertise on a solely technical and scientific basis in all technical and scientific fields of nuclear safety. Therefore, staff members who are well trained in their respective technical and scientific areas are necessary to maintain the international state of the art. Such comprehensive support can only be fulfilled by the TSO if:

- A programme is available to develop and maintain the expertise on nuclear safety;
- Research activities are ongoing to gather independent knowledge on safety issues;
- International cooperation is undertaken to complement and maintain its areas of competence.

To preserve its support in the long term, the TSO must retain its independence from the regulator and licensee.

The expert opinions of the TSO must be independent. If a TSO also provides services to a domestic or foreign licensee (utility or vendor), it has to do so in full transparency so that when providing services to a regulatory body it is able to demonstrate that conflicts of interest are excluded.

References

- 1- INTERNATIONAL ATOMIC ENERGY AGENCY, Fundamental Safety Principles, IAEA Safety Standards Series No. SF-1, IAEA, Vienna (2006).
- 2- OECD NUCLEAR ENERGY AGENCY, The Regulatory Goal of Assuring Nuclear Safety, Rep. No. 6273, OECD/NEA, Paris (2008).
- 3- P. GOVAERTS, LEAD-IN PRESENTATION: ROLES, FUNCTIONS AND VALUE OF TSOs, Challenge faced by technical and scientific support organizations in enhancing nuclear safety, International conference, 23-27 April 2007, France.
- 4- L. HAHN, INDEPENDENT TECHNICAL AND SCIENTIFIC ADVICE FOR REGULATORY DECISION MAKING, Challenge faced by technical and scientific support organizations in enhancing nuclear safety, International conference, 23-27 April 2007, France.

- 5- K.S. KO, K.I. HAN, RELEVANCE OF TSOs IN PROVIDING TECHNICAL AND SCIENTIFIC SERVICES TO OPERATORS/INDUSTRY, Challenge faced by technical and scientific support organizations in enhancing nuclear safety, International conference, 23-27 April 2007, France.
- 6- W.D. TRAVERS, CHALLENGES FACED BY REGULATORS AND TECHNICAL, SCIENTIFIC AND SUPPORT ORGANIZATIONS (TSOs) IN ENHANCING NUCLEAR SAFETY AND SECURITY, Challenge faced by technical and scientific support organizations in enhancing nuclear safety and security, International conference, 25-29 October 2010, Japan.
- 7- INTERNATIONAL ATOMIC ENERGY AGENCY, Effective Nuclear Regulatory Systems: Further Enhancing the Global Nuclear Safety and Security Regime (Proc. Int. Conf. Cape Town, 2009), IAEA, Vienna (2010).