

Challenges in Developing TSO to Provide Technical Support in Nuclear Safety and Security to Pakistan Nuclear Regulatory Authority

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Abstract. This paper highlights the needs for the establishment of a technical support organization (TSO) in Pakistan Nuclear Regulatory Authority (PNRA), challenges faced during its development, application of training need assessment required for the competency development of its technical manpower and difficulties encountered after its evolution. Key issues addressed include recruitment of technical manpower and enhancing their competencies, acquisition of proper tools required for safety review and assessment, development of a sustainable education and training program consistent with the best international practices and taking the measures to get confidence of the regulatory body.

1. Introduction

Before the establishment of PNRA, the Directorate of Nuclear Safety and Radiation Protection (DNSRP) was vested with the regulatory responsibilities and looking after the nuclear safety in the country. At the time of licensing of Chashma Nuclear Power Plant Unit-1 (C-1), it obtained assistance in the review and assessment, inspections and regulatory decisions from Nuclear Safety Centre (NSC), China. The down side was delay in regulatory decisions and involvement of huge financial resources as service charges. Moreover, availability of NSC expertise in regulatory affairs became difficult as a result of their involvement in the Chinese fast growing nuclear power program. In view of this, development of own capabilities for regulating and licensing of nuclear installations was strongly recognized.

Since, the establishment of PNRA in 2001, it mainly focused on the capacity building and manpower development with the aim of becoming a world class regulatory body. It initiated a Technical Cooperation Project under which the International Atomic Energy Agency (IAEA) provided assistance in arranging fellowships and scientific visits for the technical staff both at the Agency and in foreign regulatory bodies. Most of the technical officers received trainings abroad. Beside this, it also started working on the Training Needs Assessment (TNA) with the objectives to identify areas where training and refresher courses will be required. The results of TNA recommended the establishment of a TSO to provide technical support to the regulatory body.

This papers provides an overview of the establishment of TSO, main challenges faced at the time of its development and delineates initiatives taken for overcoming these challenges.

2. Establishment of CNS

In June 2005, PNRA established the Centre for Nuclear Safety (CNS) as a Technical Support Organization (TSO) to provide technical assistance in the design review of nuclear power plants, right from siting, manufacturing, installation, commissioning, operation till decommissioning phases. Other tasks included initiation of safety related research and development work in PNRA. Nuclear Safety Centre of China was initially chosen to be a model TSO for developing CNS. Main functions of the TSO included the following.

1. To provide technical support in safety review and licensing decision making to different directorates of PNRA in relationship with safety issues of NPP.
2. To perform independent audit calculations and conduct safety research and development work in different areas of safety analysis.

The TSO had to develop its capabilities for performing independent calculations and conduct safety research and development work. Therefore, a number of computer codes and software were needed to perform confirmatory and audit calculations for Design Basis Accidents (DBA), Beyond Design Basis Accident (BDBA) analysis, Computational Fluid Dynamics (CFD) analysis, Seismic Analysis, Probabilistic Safety Assessment (PSA), Structural analysis and Thermal Hydraulics design, etc. to verify the safety cases prepared by the licensees.

PC versions based state of the art computer codes and plant simulators such as RELAP, MELCOR, MACCS, CONTAIN, ANSYS, RISK SPECTRUM etc were utilized for developing independent capability to perform safety analyses. A group for review and assessment was established in CNS to evaluate the licensee's submissions on the basis of national regulations and international codes, guides and standards. The review and assessment provided input for licensing decision making to the regulatory body.

3. Development of Competency Model for TSO

PNRA carried out Training Needs Assessment (TNA) for its TSO on the basis of the IAEA four-quadrant competency model given in IAEA TECDOC-1254 with the objectives to identify the areas where competencies were required. Following IAEA four-quadrant competency model was adapted for the study as shown in figure 1.

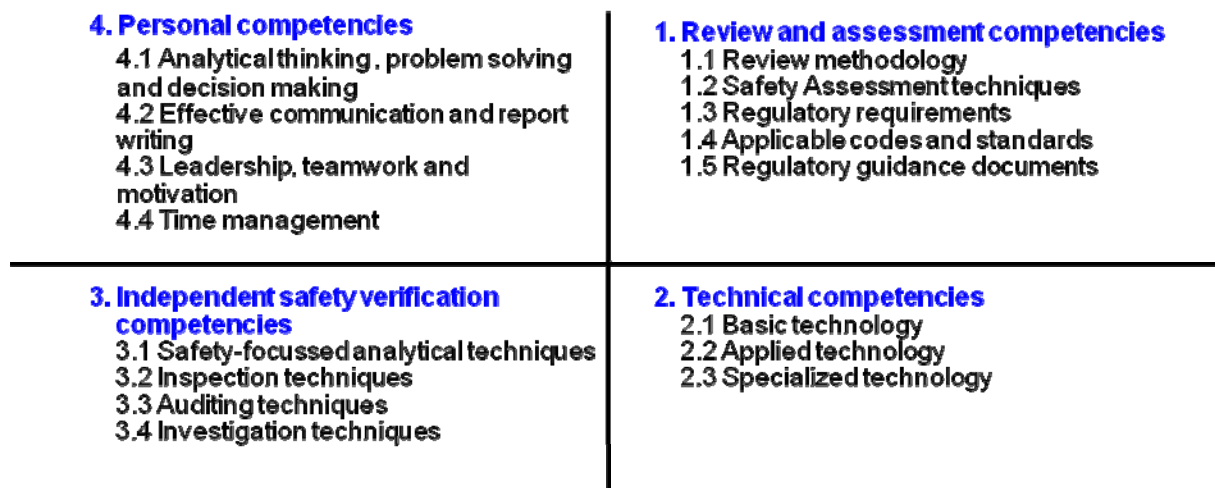


FIG.1 Four-Quadrant competency model developed for TSO

This study identified key areas where further trainings were required.

4. Challenges in Development of TSO

The first challenge that TSO faced right from its inception was manpower recruitment. Three possibilities existed to recruit manpower either from PNRA or PAEC or induct fresh university graduates directly. A combined approach was adapted by taking workforce initially from PNRA for starting the work and also recruiting fresh graduates directly, preferably nuclear engineers.

Appropriate training in the relevant fields for the newly recruited young engineers and scientists was particularly significant and the training needs were identified at an early stage. Training programs were chalked out mainly with the help of NSC and NNSA in China. Limited support was available in terms of training opportunities and funds/fellowships. China agreed to accommodate the trainees and IAEA awarded some fellowships through TC project and arranged expert missions for PNRA. IAEA also conducted few workshops and seminars to provide training in safety review and assessment.

Another important task was to identify and procure suitable tools required for safety analysis. These tools included the computer equipment and software needed to analyze and study the behaviour of plant components and structures under normal operation and accident conditions. Computer codes and software were acquired to meet the demands of analyses groups formed in CNS.

The role of CNS was to provide technical support in safety review and licensing decision making to different directorates of PNRA with regard to safety issues of nuclear power plants and research reactors, to perform independent audit calculations and conduct safety research and development in different areas of safety analysis. The existing directorates of PNRA involved in review and assessment of licensee's submissions were reluctant in sharing assignments with CNS because they were of the opinion that the technical officers were comparatively young and less experienced and their work would be only vetting.

5. Overcoming the Challenges

Mock reviews were carried out for capacity building of TSO. C-2 PSAR originally reviewed by PNRA was re-reviewed by CNS officers and through this exercise they went through the review process. In parallel, independent safety analysis through probabilistic and deterministic approaches was initiated using various computer codes. Independent safety analyses were an added advantage that built confidence in other directorates of PNRA about the potentials of their TSO. With these poising measures, CNS was gradually tasked to participate effectively in review and assessment activities for licensing of nuclear power plants.

Initially, all the assignments came through Nuclear Safety Directorate (NSD) which was responsible for licensing of nuclear installations. NSD provided the interface and scientists and engineers from TSO were invited to participate in the review of revised KANUPP Final Safety Analysis Report (KFSAR), design modifications of C-1, commissioning program of C-2 and as experts for inspection at manufacturing and nuclear facilities sites. With the high level of confidence entrusted in the TSO by other directorates of PNRA including the three regional nuclear directorates, TSO redefined its role to become more energetic, ready to accept new challenging tasks and move forward with new level of confidence.

Since its inception, TSO provided support to the Directorate of Nuclear Safety (NSD) in conducting safety review through qualitative and quantitative assessments in different areas such as reactor, electrical systems, accident analysis (including DBA and beyond DBA analyses), Probabilistic safety analysis (PSA) and human factor engineering. In addition, capability was developed through local and foreign assistance to perform independent audit calculation in the areas of fuel neutronics, accident analysis, stress analysis, seismic analysis and computational fluid dynamics. CNS recruited new scientists and engineers under the capacity building project. An intensive professional training program was planned to develop their competencies, knowledge, skills and abilities which ultimately improved the effectiveness and efficiency of the organization. A number of specialized training courses were designed to educate the new entrants in various field of nuclear safety.

At present, CNS is independently reviewing C-2 Final Safety Analysis Report (FSAR), participating in periodic safety review (PSR) of C-1 and performing safety analyses and audit calculations in the fields of probabilistic safety assessment (PSA), thermal hydraulics, fuel neutronics, stress analyses, etc. thus helping Pakistan towards indigenization in licensing of NPP and saving considerable amount of foreign exchange.

6. Conclusions

Development of TSO is a difficult task, particularly selection of a relevant competency model. All regulatory bodies need to define structure and responsibilities of TSO according to their own requirements. A TSO has to keep the regulatory body (RB) informed about its capabilities and

working and gain confidence of the RB so that it may disseminate assignments effectively. Capacity building of TSO can be carried out through mock reviews. Investing in training is very essential for developing a TSO and the required competencies of the technical staff need to be defined at an early stage. In the changing technological, economic and social environment, TSOs are now facing a number of challenges that they, together with the regulatory bodies, must address for more effective nuclear safety regulation.

7. References

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