A systematic approach to training aimed to improve the efficiency of npp personnel training

D. Dimitrov[1], N. Randelova[2]
Institute of Metal Science Equipment and Technologies with Hydroaerodynamics Centre "Acad. A Balevski", Sofia, Bulgaria[1]
Kozloduy Nuclear Power Plant[2]
E-mail: ddimitrov@ims.bas.bg, NSRandelova@npp.bg

Abstract: *The Systematic Approach to Training (SAT) is a logically structured process based on job analysis whose aim is to ensure that the personnel have the necessary knowledge, skills and attitudes to effectively perform their assigned tasks. The SAT is a flexible system that can be adapted to the needs of any nuclear power plant and any job position.*
KEYWORDS: *NUCLEAR FACILITIES, SYSTEMATIC APPROACH TO TRAINING, MANAGEMENT SYSTEMS, PROTECTION OF NUCLEAR INSTALLATIONS, REGULATORY FRAMEWORK*

1. Introduction

The Systematic Approach to Training (SAT) is a logically structured process based on job analysis, whose aim is to ensure that the personnel have the necessary knowledge, skills and attitudes to effectively perform their assigned tasks.
The SAT includes five interrelated stages:
1. Analysis;
2. Design;
3. Development;
4. Implementation;
5.Evaluation.
These stages are not applied linearly and in a one-off fashion, but in a circular and continuous manner so that the results of the evaluation feed back into the other phases. The SAT is a flexible system that can be adapted to the needs of any nuclear power plant and any job position.

2. Overview of the activities included at the different stages

Appropriate training ensures that each member of staff is informed about the meaning and significance of the work they are performing and about how their work contributes to safety and to the achievement of the Company's goals.

2.1. Analysis

The analysis phase aims to determine what knowledge, skills and attitudes are required for each job position. Methods used include:

- Job and task analysis;
- Competency analysis;
- Interviews, surveys, observation, documentation.

The ultimate goal is to produce a list of:

- Required knowledge, skills and attitudes;
- Critical tasks;
- Terms of performance;
- Frequency and importance of each task.

2.2. Design

At this stage, the following is determined:

- The structure of the training program;
- The learning objectives;
- The training methods (e.g. simulators, lectures, on-the-job training);
- The assessment methods – tests, practical demonstrations, observation.

The design stage ensures that all critical knowledge, skills and attitudes identified at the analysis stage will be covered by the program, and that the training will be aimed at achieving specific results.

2.3. Development

At this stage the following are created:

- Training materials (manuals, presentations, simulator scenarios);
- Assessment tools (tests, checklists, feedback forms);
- Instructor guides and lesson plans;
- Scenarios for emergency or extraordinary situations, if needed.

The development stage should provide all the necessary resources to deliver the training effectively and in accordance with the requirements set at the analysis and design stages.

2.4. Implementation

This is the stage in which the training is done for real, by using the materials and methods developed at the previous stages. Key aspects here include:

- Planning and organizing training courses;
- Teaching in the classroom, with a simulator or on-the-job training;
- Monitoring the effectiveness of the training;
- Documenting participation and results.

Employees must demonstrate that they have acquired the required knowledge, skills and attitudes before being allowed to perform their tasks independently.

2.5. Evaluation

Evaluation is a continuous process that is applied at every level:

- Trainees' assessment - have they achieved the objectives?
- Evaluation of the training program - is it effective?
- Trainers' evaluation - are they performing their role well?
- Impact evaluation - does the training contribute to better performance and safety?

The evaluation allows:

- Improvements in the training content or methods;
- Identification of new training needs;
- Evidence of regulatory and internal purposes;
- Feedback to the management on the effectiveness of the investment in the training.

The systematic approach to training is not just a "good practice" but a necessary system for managing the competence of the personnel in the nuclear sector. It provides structure, transparency, sustainability and continuous improvement.

3. Key features and benefits of SAT

SAT is recognized as **the best international practice** for developing and implementing effective training programs in the nuclear industry. Its application brings about a number of key benefits that cover the **quality, effectiveness and sustainability** of the training.

3.1. Key features of SAT

SAT is characterized by the following key features:
- Job-or competency-based analysis:
Training programs are based on a systematic analysis that determines what knowledge, skills and attitudes are needed to perform certain tasks in a job.
- Clearly defined learning objectives:
Each training module has specific and measurable objectives that indicate what the trainee should know and be able to do upon completion of the program.
- Content and methods tailored to the objectives:
Appropriate methods, tools, and materials are used that are directly related to the learning objectives and the trainees'' profiles.

- **Performance assessment**:
Trainees are assessed against predefined criteria. This includes theoretical tests, practical demonstrations, observation, etc.
- **Evaluation and feedback**:
Training programs are periodically evaluated to ensure they are relevant, effective and in line with the needs of the nuclear plant.

3.2. Main benefits of the implementation of the SAT

The implementation of the *SAT* leads to significant benefits for nuclear power plants and operating organizations, including:
- Increased safety: by providing adequate training, the employees are better prepared to respond appropriately to normal, abnormal and emergency situations.
- Increased efficiency and productivity: well-trained personnel work faster, better and with fewer errors.
- Optimal use of resources: SAT helps to direct training only at the really necessary KSAs, thus reducing unnecessary costs.
- Better documentation and traceability: every stage of the training process is documented, which facilitates audits and regulatory oversight.
- Increased motivation and satisfaction of personnel: trainees perceive the training as targeted, applicable and respectful of their roles, which improve staff engagement.
- Better preparation for new technologies and changes: SAT allows flexible adaptation of the training when introducing new equipment, software or organizational changes.
- Improved safety culture: by incorporating KSAs related to human factors, SAT promotes responsible safety behavior and thinking.

In summary, SAT is not just a training methodology - **it is a strategic tool for managing competence, risk and quality** in a nuclear power plant.

4. Applying the Systematic Approach to Training

4.1. Establishing a training system based on SAT

The training system in a Nuclear Power Plant should be formally recognized by the management of the operating organization and should have a clearly defined structure, responsibilities and resources. In this context, SAT is used as a methodology for:

- Developing training programs;
- Implementing effective training;
- Achieving and maintaining competence;
- Facilitating assessment and continuous improvement.

The system should be supported by written policies and procedures that clearly state:

- The objectives and scope of the training;
- The responsibilities of the different units;
- The interaction between the training organization and the operational departments;
- The quality control and performance evaluation mechanisms.

4.2. Stages in the introduction of SAT

The introduction of SAT into an existing training system requires a staged approach that ensures smooth transitions and makes maximum use of the resources already available.
Recommended stages include:
1. Analysis of the current training system:
- What programs exist?
- What methods are being used?
- How is effectiveness evaluated?
2. Training of key SAT staff:
- Training of managers, instructors and training specialists;
- Introductory courses and practical workshops.
3. Identifying priority positions and programs:
- For example: operators, electricians, maintenance personnel;
- Focusing on safety-related positions.
4. Developing and implementation of SAT-based programs for safety-related positions:
- Starting with pilot programs;
- Using the results to refine subsequent programs.
5. Expanding the scope of SAT to other positions and activities:
- Gradual inclusion of management, administrative and subcontractor staff.
6. Establishing a mechanism for continuous evaluation and improvement of the system.

4.3. Key conditions for the successful implementation of SAT

For the effective introduction and sustainable implementation of SAT it is needed:
- Active support from the senior management of the operating organisation and the nuclear plant;
- Appointment of a competent team responsible for the management of the training system;
- Ensuring sufficient resources - staff, budget, technical facilities, and premises;
- Continuous training and development of trainers and training specialists;
- Cooperation between the operational units and the training structure;
- Integration of SAT into human resources, quality and safety management systems.

5. Conclusion

- The implementation of SATs is not a one-off project but a continuous improvement process;
- Existing training programs can be adapted and not necessarily replaced in their entirety;
- SAT allows flexible implementation according to the capabilities and needs of the specific organisation;
- The initial effort is significant, but the long-term benefits outweigh the investment.

The implementation of SAT is a strategic investment in the **competence, safety and efficiency** of a nuclear power plant.

References

- Law on the Safe Use of Nuclear Energy;
- IAEA. Nuclear Power Plant Personnel Training and its Evaluation: A Guidebook. Technical Reports Series No. 380. Vienna: International Atomic Energy Agency, 1996;
- IAEA. Recruitment, Qualification and Training of Personnel for Nuclear Power Plants. Safety Guide NS-G-2.8, Vienna, 2002;
- Quality Management System. Requirements, ISO 9001:2015.