Improvement of the NPP personnel simulator training

V. Tarykin

National Nuclear Energy Generating Company "ENERGOATOM",
Khmelnitsky NPP, Ukraine,
tarykinv@ukr.net

ABSTRACT

It is a common practice to have a full-scope training simulator for a specific plant or for a group of similar plants; this is widely used for operator training in a full range of plant operating conditions and for emergency training. However, use of a full-scope simulator for training is not always effective. Use of a full-scope simulator becomes more effective if to use the modular scheme of training and more simple simulators for a pre full-scope simulator training.

1. INTRODUCTION

State enterprise National Nuclear Energy Generating Company "ENERGOATOM" (NNEGC "ENERGOATOM") integrates four Ukrainian nuclear power plants (NPP): Zaporizhzhya NPP, South–Ukrainian NPP, Rivne NPP and Khmelnitsky NPP. The training centers (TC), formed at each NPP, provide the simulator training of operating personnel.

The Ukrainian NPP personnel training system is based on methodology of the Systematic Approach to Training (SAT). This means that simulator training is a part of an effective and controlled training process.

The existing training methodical support makes an analysis of the training needs, training programs and qualification of maintenance, methods of sessions and courses for the simulator training, the analysis and assessment of the training effectiveness, and the quality assurance system for the training center departments.

Each of Ukrainian NPP training centers has the Full Scope Simulators (FSS): Zaporizhzhya NPP – 3 FSS (6 units in operation), South–Ukrainian NPP – 2 FSS (3 units in operation), Rivne NPP – 2 FSS (3 units in operation), Khmelnitsky NPP – 1 FSS (2 units in operation).

The FSS as an educational tool has a very strong influences on personnel training quality.

The major tasks for FSS use are:

· Initial training and continuing training of the Main Control Room (MCR) operating personnel.
· Adjusting to new control strategies.
· Validation of new operation and emergency procedures.
· Transients simulation and analysis in cases of emergencies taking place at NPP.

Except for the FSS, other simulators (basic principle simulators, partial-scope simulators) are used also in the Ukrainian TC for training the personnel (mainly non-MCR personnel). But FSS is used only for MCR operation personnel training.

There are several reasons for this. The main reason is the realistic environment of a FSS.

Full-scope simulators, which are full replicas of the MCR equipment, are currently a standard tool for various phases of operator training in most countries and utilities.

Partial scope simulators describe only a limited part of the process. They can be used in training at the system operation level.

Basic principle simulators include the physical models, but there is no real operator interface.

Although partial-scope simulators and basic principle simulators can provide all the necessary quantitative information during an exercise or drill, they cannot provide the realistic environment of a FSS.

The FSS exposes the same type of physical environment that trainee would experience during an actual event and is therefore a very suitable tool for detecting weak points in trainees actions. The more realistic the simulator, the more effective this function is.

Further realism is also achieved due to a larger number of operator actions, i.e. also to those actions that were not foreseen during the preparation of the drill.

The FSS will also clearly and realistically display the negative consequences of non-correct operator actions.

Only FSS can provide teamwork skills for the MCR operating personnel.

2. EXISTING PROBLEMS AND METHODS OF THEIR DECISION

The initial MCR personnel training should be effective to prepare the qualitative operator in a limited time frame.

According to Ref. [1] the operator training cycle is divided into the following phases:

(1) instruction in the basic principles,
(2) training related to specific functions,
(3) training covering the full operating range,
(4) detailed accident training for the application of emergency operating procedures (EOPs).

The classical sequence of MCR operator initial training is: the classroom training and the FSS training. Both types of training are separated.

Unfortunately, the classical scheme of training, which exists now in educational process in Ukraine and in many other countries, is not effective.

Duration of the theoretical training is very long (several months). The trainee forgets by the end of training what was taught in the beginning. The knowledge is forgotten without practical training.

There is a certain "long distance" between the theory and practice. To avoid this “distance”, it is necessary to:

· use so-called modular scheme of training (all training program is allocated into modules which consist of theoretical part and practical one);
· add FSS demonstration sessions in the theoretical training (theoretical parts of modules);
· use more simple simulators (basic principle simulators, partial-scope simulators) as «the bridge» between the theoretical class room lessons and FSS training sessions.

3. MODULAR SCHEME OF MCR PERSONNEL TRAINING

The so-called modular scheme is applied to MCR operators training in the Khmelnitskiy NPP training center. The theoretical training and practical training are mixed and connected among themselves. The training program is allocated into modules and each module represents a piece of the theory and it is connected with the practical training (on a simulator and/or on a on-the-job-training (OJT)). Such a scheme allows to acquire the studied material better. The practical training is based on the FSS demonstration sessions, but can include OJT on the real MCR. Such an approach raises efficiency of the training process because the theory is connected to practice.

The modular scheme of training including the FSS demonstration sessions is widely used at Khmelnitsky NPP for the MCR operator’s initial training.

4. PRE – FULL SCOPE SIMULATOR TRAINING

The use of basic principle simulators and partial-scope simulators is effective for initial training (pre – full scope simulator training) of the future MCR operator. It allows for a better understanding the main principles of complicated technological systems operating before the FSS training. Such pre – full scope simulator training prepares the trainee to FSS sessions.

5. CONCLUSION

The FSS is valuable not only by similarity with MCR, but opportunities of its use as training tool. The purpose for using FSS is not only for the maintenance of operations skills, but also the preparation for acceptance of the conscious decisions. It is necessary to create and to use a complex of simulators by the principle "from simple to complicated" – from partial-scope simulators and basic principle simulators to the FSS. The using of such simulators complex, can improve the simulator training quality as well as general training quality.

The initial training of the MCR operating personnel demands application of more simple simulators at a stage of the technological systems operation common principles studying. It is necessary to use FSS at the closing stage of training. The attention of trainee should be focused not on similarity of FSS and MCR, but on making of correct decisions.

The modular scheme of MCR operating personnel initial training including the FSS demonstrations sessions makes the training process more efficient.

6. REFERENCES

VAN BILLOEN, G., “Classification and Optimization of Training Tools for NPP Simulator”, Specialist Meeting on Simulators and Plant Analyzers (Proc. Symp. Lappeenranta, (1992), VTT-SYMP-141, NEA/CSNI/R(93)11, VTT, Espoo (1994).

“Application of simulation techniques for accident management training in nuclear power plants”. IAEA-TECDOC-1352. May 2003.