

**PROBLEMS AND TASKS OF TRAINING AT COURSES FOR ENHANCEMENT OF
QUALIFICATION IN THE RADIOACTIVE WASTE MANAGEMENT AREA**

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ABSTRACT

Requirements to the professional competence of the personnel engaged in the area of the radioactive waste management are increased. Higher school cannot supply the branch with the qualified personnel; therefore special attention should be given to the system of staff retraining and to the increase of their qualification. In that paper the analysis of SIA "Radon" experience on the organization and carrying out training at courses of qualification improvement is represented. The main criterion of the analysis is the research of an education efficiency. Also here the basic directions of the training process improving are submitted as well as the requirements that should be considered when forming the teaching staff and trainees groups.

INTRODUCTION

The system of technical education and practice of any country reflects on a level of the industry, but with some delay, in particular because of distinctions in speed of existing knowledge mastering and rates of scientific and technical development [1]. In Russia the need of high school improving is connected with the transition of economy to the market relations. Now we have a strong want for the training of the specialists that will be claimed by a society. Such a situation concerns to the sphere of the radioactive waste (RW) management now undergoing cardinal changes connected with the statement of a new approach to the radiating safety problems and with the development of new technologies. The aggravation of ecological problems has caused severity of the sanitary-epidemiological requirements and the efforts on the international mode of nuclear and radiation safety creation. As it submitted in the IAEA documents, the part of the human factor in radiating incidents is great and the observance of the high safety standards is possible only if the staff is high-skilled.

The tutoring of radioecology in the Russian high school began recently and offered studying isn't enough for the practicing specialists' training. For example, the developing programs can give only a common view about such aspects of problem as the safety of handling with radioactive substances, as legislation that regulates and normalizes these operations [2].

The existing system of a specialists retraining responded to its tasks, but it needs improving to react to the new inquiries fast. The solution of this problem is complicated by the economic instability, by absence of the detailed elaborations and of the required manuals.

SIA "Radon" system of training and raising the qualification level was founded in 1983 by the chemical faculty of Moscow State University named after M. Lomonosov together with our Association. By this time 410 people have passed training on the courses of qualification improvement. Since 1997 functions holding of all kinds of training in the RW management area were assigned to a special department of Association. The basic staff of the trainees is personnel (including managing) of the regional enterprises specialized on the RW rendering (in Russian Federation there are 16 such centers). The representatives of the other organizations, connected with the RW management (Ministry of Emergency Situation, Ministry of Internal Affairs) and supervising organizations (Ministry of Health, State Supervision Atomic Authority, State Supervision Environmental Authority) pass training, too. The department also carries out International Demonstration Courses established in 1999 under the aegis of IAEA (with the assistance of Ministry of Atomic Energy) on the basis of SIA "Radon" and State Scientific Center VNIINM named after A.A. Bochvar. These Courses are created for training of the specialists on the RW management from the countries of Eastern Europe and from the other neighboring states. Besides, our educational department organizes and carries out an individual scientific and technical training for the foreign experts.

The education programs foresee an opportunity to share SIA "Radon" experience in the RW management. Quality of these programs efficiency and organization of the educational process and a teaching level are highly appreciated.

In this paper the analyses of a 5-year training department's experience is submitted (for this time 98 people have passed training on the Russian Courses; 23-on the International Courses; 15 of them-on the individual program). The main criteria of the analysis are the efficiency and quality of training, which are the parts of a complex technological educational process:

- conceptual forming of training principles and the purposes of a course;
- a course program as the general means of training support;
- schedule and planning of a course; system and plan of teaching;
- methods of training; representing forms of the separate course elements;
- educational and methodological maintenance of the program; of training;
- forming of the requirements to the teachers and instructors;
- forming of the requirements to the trainees;
- methods of the educational process control;

- forms of the trainees attestation.

IAEA recommend to use the system approach to training for the raise of a qualification level of the specialists in the nuclear power area [1]. In the basic of this approach is a principle of the dividing activity on the particular components. According to the system approach the forms, methods and means of training can be modified, and this makes it economically effective. The examples of such a training are submitted in [3,4].

Conception and contents of the training program.

The content of the education programs of additional training is defined by the purpose of training/retraining: the RW management personnel's skills should correspond to the qualifying requirements [1]. The achievements of this purpose is possible if the students get knowledge of the basic theoretical laws, principles of the RW management safety.

The educational program developed for the disposal sites' staff training (considering professional differences in the trainees' groups) covers the whole study of the LLW and MLW management. When designing it, the differentiation of educational, special and practical training was considered (with the preference of the practical skills). It is important to note that it was a difficult task to make the program equal in its theoretical and practical parts. Inclusion in the program a large block of theoretical disciplines (for example, "Introduction in nuclear physics", readable by the teachers of the chemical faculty of MSU) is perceived by a part of trainees as an unessential thing.

10% of the trainees would like to cut the theoretical part of training; 38% (in 2001) supported the practical part increasing; 92% considered the practical block of training as a course advantage.

The necessity of making some changes in the program is caused by the restriction of the radiation safety requirements and by the increase of the administrative devise representatives (between the trainees). Also a new category of the trainees from supervising organizations has appeared. These changes require an educational time increase, assigned to questions of legal regulations and safety culture.

The flexibility of the educational program gives an opportunity to amend it if there are any suggestions from the trainees.

The maintenance of the program (developed on the basis of the IAEA recommendations) of the International Demonstration Courses is more balanced and that helps to make the groups of trainees equal. Module structure of this program allows to amend it when required.

But even a well-designed program, based on the logic scheme, only sets a high level of training. The quality of knowledge, receiving by the trainees, is provided with a professional realization of this program.

Forms and means of training.

Forms of training used on the courses are traditional: lectures, seminars and practical classes. All participants of the training process mark the efficiency of the practical exercises, that help to get steady work skills.

The training computer program covers 11 general sections of the training course. The questions on each section allow the trainee to reveal his deficiencies and to find out if the additional study is necessary. The computer training gives an opportunity to repeat a finished material and to choose a rate of training by yourself.

The combined training course, which consists of practical and theoretical material, is carried out by the SIA "Radon" experts. Use of the training PC programs allows to save some study time. Here is required the specially developed complex of the various materials, which represents methodical support of the studying subjects. Complex of the materials (developed by SIA "Radon") includes technology manuals and standards of our enterprise. Particular attention is paid to the materials for the practical exercises performance (there was developed a large set of the registration forms filled with the trainees individually) this complete set is the valuable manual for the further professional work.

The reception of qualitative knowledge is impossible without the maintenance of educational process with the special literature. The comprehension of the received information requires additional time and presence of the special manuals (which give an opportunity of an independent study of a theoretical material). That's why the equipping of educational process with the teaching aids is considered to be one of the most vital problems, which requires certain skills and high expenses.

By virtue of the objective reasons it is impossible to offer the trainee the whole volume of a theoretical material (on the RW management). But the presence of the manual will allow to spare more time to the practical training, leaving a part of a material for the self-study and revising.

That's why the compilation of lectures of the SIA "Radon" experts was an important stage of the training process methodical equipping. This manual covers all basic questions of the safe RW management (handling, gathering, transportation, basic methods of processing and conditioning of waste their storage and burial places, environmental protection, etc.). It should be noted that now the manual has a fragmentary form (the lectures differ on the completeness, details and their style; the level of difficulty of an offered material is also different) which is inevitable at the collective cooperation

(MSU and SIA "Radon"). In the second edition of the manual (2000) some defects were removed. The task of next editions is to unify the material for readers convenience as clear as possible. In the work of making the manual we are guided by the general principles of the teaching process in a high school, considering our self-experience and peculiarities of an additional training.

1. The material selection should cover the whole range of questions for the trainees of different specialization:

- the description of all technological process with an inclusion of the theoretical bases, necessary for comprehension;
- the rise of attention to the questions of legal regulations and radiation safety;
- inclusion of materials connected with the documentation at the RW management.

2. The comprehension difficulty level should be aimed at the trainees with the different levels of education and personal abilities.

3. For simplification of the self-study with the manual and knowledge control the following conditions are necessary:

- a logic work-out of the whole manual and its separate sections;
- a clear explanation of the used concepts;
- the accuracy of the headings;
- the presence of tasks, control questions and tests with answers, and comments, practical examples and figure data;
- the presence of an illustrative material (schemes, diagrams, etc.);
- inclusion of the designed literature list (with the literature on theoretical disciplines too).

Formation of the requirements to the teachers and trainees.

The well-developed training program can't be realized without the competent teachers, because the wag of paraphrase can change the trainees' attitude to studding [1]. Having a freedom in the topic's report, a teacher should know some methods of teaching, for example:

- despite his own preferences, he must include in the program all main (important) questions;
- he must ensure a sufficient scientific level of a material;
- he should possess a high level of mentality to be able change the way of material's statement;
- he should be able to combine different kinds of training;
- he should be able to explain the material clearly;
- he must have a clear (oral) speech;

- he should be able to come into contact with the audience.

The courses' functioning has revealed the problem of a pedagogical qualification of the enterprise's staff (the teachers and the lecturers). The main criterion of teachers' selection for the courses is their professionalism. For example, the lectures on the technologic of RW processing are read by the SIA "Radon" specialists. (It should be noticed that the higher school teachers also don't receive a pedagogical education, the staff selection there is based on the specialization in the single science and technology areas [6]).

The analysis of lectures' rating made up by the trainees is sometimes very important. Despite some subjectivity of this rating, connected with the different readiness and abilities of the trainees, annually the same lectures have the highest appraisal. The specialists, who read them, possess a broad scientific base and intercourse culture. The lectures, that are constantly estimated rather low, require completion.

For achievement of a high level of teaching teacher should be able to teach and be interested to make this work qualitatively. He should apply many efforts and spend a lot of time (as a rule, after a working day). Now essential problems are the increase of the competence of the teachers of courses and overcoming of the contradictions in distributions of time between official duties and participation as the teachers. These questions are necessary for solving, while the separate lacks have not turned to tradition, which is overcome far more difficultly.

Correct selection of the trainees-one of the most important conditions of the training efficiency. Program contents depends on the trainees' contingent (educational level and specialization) and in what extent it will be used in their professional activity. Of course, it is easier to make the training program for group of trainees that has educational and professional homogeneity. On the other hand, recommended by IAEA practice of joint training of the operators (engineers, technologists, health physicists) and "regulators" of the manufacture, connected with the RW management (administrative personnel, workers of supervising organs), allows two trainees' categories to understand the problems of each other and the branch as a whole.

In the sphere of traditional average technical and higher education (where there is a great demand on the educational services) the personnel marketing (based on the analysis of entrants' abilities) is used for trainees' selection. The psychologists carry out the analysis of creative abilities of an individual with the use of different rating scales. Study of this experience represents a strategic interest for us.

An increased number of the applications on our training courses puts forward a problem of trainees' selection. And as such selection is carried out without seeing, the main criteria of group formation are the analysis of needs, professional orientation and expectations of training.

It should be noticed that adult peoples training has its specificity. The demands of such a trainee are defined by the level of readiness and self-opinion about what subject's knowledge is necessary for him. The age structure of the courses for the disposal sites' staff is submitted in a fig 1. A small number of trainees in the age of 30-40 years old are the workers who are engaged in the production process (the trainees of the IAEA courses are elder). The age distinctions and difference in the training motivation are typical for the trainees (the youngsters are usually obliged to study by the authority, the grown-ups are interested in self-promotion). In conditions of the transition of a national economy to market relations the motive to training becomes more and more considerable. In last two years the number of people, who are going to study on the courses at their own request, has grown up to 20% (earlier there were only 1-2 of these trainees in a group).

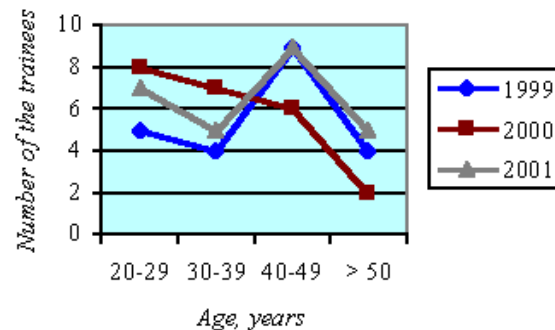


Fig. 1 Age structure of the trainees of the courses for the disposal site' staff.

At the selection of the training candidates taking into account the motives isn't enough, the specially designed technique of definition the real needs in raising the qualification level is necessary. Till now with the presence of various trainees in the group some efforts and creativity are applied for educational plans' correction. Besides, in such groups of the trainees creation of a necessary psychological atmosphere also plays an important role.

Methods of the educational process's control.

The knowledge test (certification of the trainees) is an important part of educational process, which allows to understand if the knowledge and practical skills received by trainee correspond to the purposes of training. The control of a knowledge level is also useful for the trainees, because it helps them to form an opinion about themselves. Now such control is carried out through computer testing

and oral examination. Each way of control has its advantages and deficiencies. For example, the oral examination is a subjective way of appreciation of pupils' knowledge's and skills, so it requires the certain skills of the examiner. The computer tests are deprived of such a deficiency, but oral exam gives an opportunity to estimate the understanding of some questions by the trainee more deeply (the examiner can put additional questions [1]).

The efficiency of training on the courses the disposal site's staff is appreciated by a comparison of the entrance and examination computer test's results [fig.2]. (The entrance test for a practical part of the courses is held after the theoretical part at MSU).

At making up the test we used the questions that cover the main aspects RW management. It should be noticed that the test is considered to be failed if the trainee has given less that 76% of the correct answers. 76% - 88% of the correct answers correspond to the good knowledge of a material, and 89% - 100% - to the excellent.

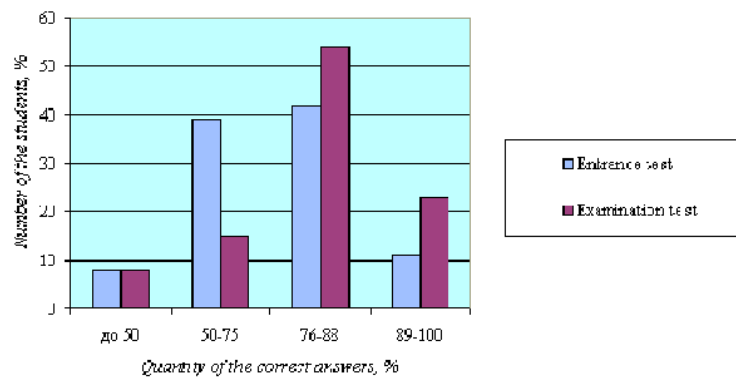


Fig.2. Results of trainees' computer testing 2001 for the disposal sites' staff.

When analyzing testing results, much attention is paid to the subjects that cause difficulties for the trainees. In the year 2001 the subject "Physical bases of radiation safety" turned out to be the most difficult for understanding (almost at 40% of the trainees) and this is a sing for its reconsideration.

The analysis of a learning efficiency allows to suppose that the best results will be achieved with the mixed form of examination: computer testing and them oral conversation with the teacher. There is a sense in consideration of the written form of examination at least for an intermediate rating of material mastering.

Directions of training perfection.

The educational plan and the program define strategy and tactics of educational process, the details of training depend on their practical realization, the control of which is not less important. Purposeful management of educational process and rating of training quality of the each trainee are incorporated in the training concept (the system approach, in the basis is the consideration of the all aspects of training).

To find out the training process efficiency it is necessary to carry out its appreciation after each session. Generally such a rating can consist of two interconnected categories - self-rating (by the staff that organizes training) and an independent (external) rating. The self-rating criteria should include the following positions:

- parameters of a training efficiency by the examination and testing results;
- the program of training (if it satisfies the trainees);
- quality of the readable lectures;
- quality and efficiency of the seminars;
- quality of the practical lessons;
- duration of the training course;
- condition of the educational and visual manuals;
- organizational aspect of the training course realization;
- common condition the training center activity;
- presence of feedback with the trainees.

For a critical rating of the training center activity the comparative analysis of the courses realization is carried out (an initial level of trainees' readiness and results of examinations, a motivation to training, etc. are taken into-account). The comparative analysis helps to reveal objective regularities, to open some new opportunities, to find out the sites, where the improvements are required. As a result of such an analysis , the directions and measures, necessary for a learning efficiency increase, are determined:

1. Standardization of the educational program:

- balance of the theoretical and practical courses parts;
- specification of the training needs of staff's various categories;
- orientation of the educational process to the study of modern technologies in the RW management area;
- improvement of the informational training;

- development of the practical classes;
 - perfection of the subsidiary training purposes.
2. Increase of both pedagogical level and technical readiness of the instructors and teachers:
- creation of a floppy system of teacher's work stimulation;
 - development of the qualifying requirements to the instructors.
3. Development of trainees selection technique:
- development of a revealing technique (at the stage of training cycle's preparation), that will show the needs of the potential trainees and an opportunity them;
 - perfection of the students' certification system (development of the new questionnaires for the teachers);
 - improvement of the testing quality (reconsideration of the examination questions on the basis of the received experience);
 - standardization of trainees' work parameters, conformity of the training ratings to the qualifying requirements of the concrete posts.
4. Improvement of manuals' quality.
5. Perfection of the programs of the foreign experts' individual scientific visits.

When planning a training course one more aspect should be considered. It is connected with the false notion of the contents of an offered educational program or with the great expectations of the training candidates. The information, distributed about the courses, should be exact and realistic, that will cause only more trust of the interested people. The trainees should be sure that the received knowledge will be useful and will become one of the main criteria of their professional carrier.

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