

EDUCATION AND TRAINING ACTIVITIES ON PERSONAL DOSIMETRY SERVICE IN TURKEY

C. Tuğrul Zeyrek* and Hayri Akbıyık

Ankara Nuclear Research and Training Center

Turkish Atomic Energy Agency,

06100, Beşevler, Ankara, Turkey

*Corresponding author. *Tel.*: +90-312-2126230; *fax*: +90-312-2226421

E-mail address: zeyrek@taek.gov.tr

Abstract

A personal dosimetry service that evaluates the occupational doses for external and internal radiation of the radiation workers is one of the main components of radiation protection programme. The education and training (E&T) activities in this field are basic aspect of the optimization of all exposures to radiation. The E&T activities in the field of occupational radiation protection at the national and international level are mainly interested and implemented by Ankara Nuclear Research and Training Center (ANRTC) in Turkey. This study describes the Turkish experience in education and training of the staff of dosimetry services, postgraduate students and medical physics experts. The first individual monitoring training course realized in 2012 in Turkey. The aim of this study is to provide a structured description of postgraduate courses that addressed to qualified experts and medical physics experts, and the modules mainly dedicated to individual monitoring.

INTRODUCTION

The education and training (E&T) issues of personal monitoring of ionising radiation, based on the requirements provided by the Basic Safety Standards Euratom Directive⁽¹⁾ and the European Commission Technical Recommendations⁽²⁾ for personal monitoring of external radiation. According to this Directive and the Basic Safety Standards⁽³⁾, medical physics experts and qualified radiation protection experts and are responsible for either giving advice on, or implementing educational and training programmes for occupationally exposed workers. One key element for the competent national authority to fulfill its tasks-at least regulative, inspective and in some cases monitoring-is the provision of education and training to occupationally exposed workers and the staff responsible for assessment of occupational exposure.

The Turkish Atomic Energy Agency (TAEA) is the competent authority for radiation protection and nuclear safety in Turkey. The TAEA was first established with the name of the Atomic Energy Commission in 1956 as a governmental organization. The name of the Atomic Energy Commission and its structure was reformed by the new Act (No: 2690- year 1982), establishing TAEA with the main objectives of policy making on nuclear energy and technology, regulation, licensing and inspection, research and development and training. The TAEA provides specialized courses at national and regional level on radiation protection, including individual monitoring⁽⁴⁾. The purpose of this study is to present the Turkish experience in individual monitoring activities on personal dosimetry service in Turkey. The regulatory requirements and the feedback were obtained from various RP actions.

MATERIALS AND METHODS

All topics in radiation protection in Turkey are regulated and supervised by the Turkish Atomic Energy Authority (TAEA). TAEA is also responsible for individual monitoring of radiation workers in all radiation facilities in Turkey and has a mission on the national dosimetry services to preside over the necessary individual monitoring for about 30 years. Occupational exposure arises from conventional industry, health or medical sector and research laboratories in Turkey⁽⁵⁾.

Ankara Nuclear Research and Training Center (ANRTC) is affiliated with TAEA and has duties and responsibilities on national education and training and research on RP topics, such as radiation safety, nuclear safety. Public information about nuclear topics is also among the duties of ANRTC. Some specific training, such as irradiation of some specific food, non-destructive testing methods, comet assay analysis method, fundamentals of radiopharmacy, radiography and individual monitoring are carried out in Centers affiliated to TAEA, Çekmece Nuclear Research and Training Center-ÇNRTC and Sarayköy Nuclear Research and Training Center-SNRTC, under the coordination of ANRTC.

Up until 2003 ANRTC had been operating as a postal dosimetry service based only on film dosimeter⁽⁶⁾. In 2003, a decision was taken on that this system to be gradually transferred into an automated thermoluminescence dosimeter (TLD) service. The TLD wholebody service was first introduced on a phased basis between 2000 and 2003 with continuing development. The computer programs for dose calculation, data transfer, dose record keeping and accountability procedures were adapted to the new system, and the official distribution of the TLDs began in 2003⁽⁵⁾. Later on, national

individual monitoring service was started to be given by SNRTC, since 2005 in Turkey. In 2009, this service system was accredited in compliance with EN ISO/IEC17025:2005 standard ⁽⁷⁾ by Turkish Accreditation Agency (TÜRKAK).

The Procedures and Principles for Personal Dosimetry Services (PPPDS) were issued a bylaw, in accordance with the National Regulation of Radiation Safety, in Article 21, (No:23999)⁽⁷⁾, by the TAEA, in 2012. According to this new system, public and private enterprises can provide individual monitoring service to occupationally exposed workers if they are approved and licensed by the national dosimetry service. According to the PPPDS in Article 5: Conformity Criteria, a personal dosimetry service should be fulfilling the mainly topics such as sufficient number of device/detector which are appropriate detection capabilities for individual monitoring, should have sufficient technical equipment, standardization of using dosimeters, staff who are performing calibration. Dose assessments and other special tasks shall be appropriately qualified, through a combination of education, training and experience in compliance with EN ISO/IEC17025:2005 standard ⁽⁸⁾.

The information of the occupationally exposed workers in matters of personal dosimetry and the proper use of their dosimeters are crucial for the effective implementation of any individual monitoring programme. Therefore, TAEA has also provides courses on radiation protection adapted to needs of the country. Such courses are organised periodically and include issues of individual monitoring as well ⁽⁴⁾.

First pilot apprenticeship training course on individual monitoring were carried out, and evaluated by ANRTC in 2012. The training course aimed at to train people for

dosimetry services. In this particular course the participants were postgraduate students and medical physics experts.

E&T programme for individual monitoring at local level; review of syllabus

According to the current draft of the new Euratom BSS Directive⁽¹⁾, the individual monitoring is a body or a person having the competence for calibration, reading or interpretation of individual monitoring devices, or for measurement of radioactivity in the human body or in biological samples, whose capacity to act in this respect is recognized by the competent authorities. According to the new provisions, Member States shall make the necessary arrangements for the recognition of the individual monitoring. Furthermore, E&T and retraining programmes shall be in place in Member States, to allow the recognition of individual monitoring. Among the recognition criteria for external individual monitoring provided by the RP160⁽²⁾ is the requirement for qualified staff, as well as the requirement for establishing a Quality Management System (QMS). As far as staff qualification of an individual monitoring is concerned, the QMS provides that due consideration has to be given by undertaking at the stage of personnel recruitment. This, also complies with International Atomic Energy Agency^(10,11), recommendation that the establishment and implementation of a national strategy for building competence in individual monitoring through information, education, training and retraining programmes addressed to the individually monitored personnel is required.

Concerning the legal requirement for appropriate education, training and retraining to be in place in dosimetry services, this is also an issue to be tackled with by

an established QMS. The QMS shall formulate the goals with respect to the E&T skills of the dosimetry service personnel ⁽⁷⁾. The service shall have the policy and procedures for identifying training needs before providing training to the personnel ⁽⁷⁾. The structure of any relevant training or retraining programme should take into account the main tasks to be carried out by the staff of dosimetry services.

Training and retraining of the staff shall be repeated in appropriate intervals and must be well documented. In order to fulfill the tasks of a dosimetry service as described in the EC BSS⁽¹⁾, the E&T programme addressed to the staff and the main learning objectives concerning the skills that participants are expected to have attained upon the completion of the training are as follows:

- Comprehend radiation physics, radiation health effects and radiation protection principles,
- Acquainted with the radiation protection international system and national legal instruments,
- Familiarize with the measurement of radioactivity in the human body and in biological samples,
- Familiarize with methodologies regarding the assessment of doses,
- Familiarize with QMS procedures,
- Enhance coordination between dosimetry services and undertakings, occupational health services, qualified experts (QEs) (or radiation protection experts (RPEs)) and competent authorities,
- Develop competence on new monitoring technologies.

In Turkey, the training course on individual monitoring is included in the syllabus of the TAEA. The syllabus has the following content in the final course programme according to the EC BSS recommendations and national PPPDS conformity criteria:

- Fundamental concept of ionizing radiation (units and conversions, radiation measurement and detection, biological effects of radiation),
- National regulation for radiation security,
- The radiation protection system and national legal instruments,
- Type and properties of dosimeters,
- Applications field of dosimeters and develop competence on new monitoring technologies,
- Conformity criteria for dosimetry services,
- Compliance with EN ISO/IEC 17025:2005 standard for dosimetry services,
- Calibration procedures,
- Accuracy of measurement for dosimetry systems,
- Validation of method and performance tests for dosimeters,
- National individual monitoring register and tracking system,
- The requirement for establishing a Quality Management System (QMS),
- On the job-training for individual monitoring (laboratories applications).

Figure 1 presents the percentage of total course time devoted to each subject area for the programme. As seen from the figure, course time is mainly aimed at practice as it should be in this sort of training course. Therefore, % 57.1 of total course time was assigned to laboratory practise in the mentioned training course.

In the laboratory practice, mainly Panasonic automatic thermoluminescence dosimetry (TLD) reader model UD-716AG and UD-800 series TLD dosimeters have been used⁽⁵⁾. For neutron and photon dosimetry, Panasonic model UD-809 and UD-802 personal TLDs are used together. The TLDs consists of two different Panasonic models UD-802 and UD-809. Each contain a different TL material and filtration. The UD-802 model TLD provides two different phosphor types ($\text{Li}_2\text{B}_4\text{O}_7\text{:Cu}$ and $\text{CaSO}_4\text{:Tm}$) which together with the appropriate holder allow photon and beta in pure and mixed field conditions⁽¹²⁾.

It is recommended that this also be enhanced in the next similar program planning. These courses are being envisaged to be held annually for accredited dosimetry services.

As stated above, this particular programme was realized for the first time in 2012 for postgraduate students (physicists, chemists, and nuclear engineers), medical physics experts and technicians who will take place in new national dosimetry services. The course was presented as two-week seminars and laboratory applications in practice by an experienced staff of TAEA (physicist, chemists, radiation biologists, radiation protection experts, medical physicists and QMS experts). Course notes are disseminated to all participants for future reference. At the end of the course, the participants took an exam that prepared by the experts group who involved in the course as trainer. For the participants, two different certificates were issued according to the examination results. If the examination score is ≥ 70 (with respect to 100 points), a 'Certificate of Achievement' was granted. And for the lower scores, a 'Certificate of Attendance' was issued.

At the end of the course, participants were given an evaluation questionnaire to complete for the assessment of the course efficiency in order to improvement of the future course program planning. The questionnaires are generally given for every similar course to be used to improve teaching strategies for the next training courses by ANRTC.

CONCLUSION

The regular dissemination of information by our dosimetry service to individually monitored workers, regarding the proper use of their dosimeters is essential part of the successful operation of an individual monitoring system. On the other hand, the establishment of a national E&T programme is one of the mechanisms through which an effective and sustainable individual monitoring system can be applied.

The provision of regular E&T courses and knowledge dissemination on the new techniques and methodologies addressed to the staff of dosimetry services and individually monitored workers is a key element to provide competence and ensure expertise in the field of individual monitoring.

The structure of the mentioned courses must take into account that the level of knowledge, the experience and the specific tasks of the different groups.

According to PPPDS and the assessment of the impact of this approach, public and private enterprises will be made viable for providing individual monitoring of occupationally exposed workers approved dosimetric service, now and future and revealed an increased confidence towards the dosimetry service, a relevant reduction in individual external doses in Turkey.

TAEA was the only authority to implement the national dosimetry services to provide the necessary individual monitoring until 2012 in Turkey. According to the new introduced Procedures and Principles, public or private enterprises qualified to PPPDS will also be able to provide viable individual monitoring of occupationally exposed workers as an approved dosimetric service. The introduction of the new Procedures and Principles will bring about attaching importance of the establishment of a national education, training and retraining programme which is the mechanisms through which an effective and sustainable individual monitoring system be properly applied.

Level of knowledge, experience and the specific tasks of the different groups must be taken into account in the planning phase of the course structure. For national new dosimetry services, postgraduate students (physicists, chemists, and nuclear engineers), medical physics experts and technicians should be considered as eligible participants in the courses with appropriate curricula in order to ensure continuity of expertise and create potential trainers in radiation protection.

Coupled and combined national training programmes and on-the-job training programmes have been found as an effective and efficient way for the individual monitoring, by TAEA. On the other hand, it has been considered that education and training for individual monitoring should be implemented at all levels of education including continuous training for practitioners with professional experience.

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Fig. 1 Subject areas and relative percentages of the total course time for the individual monitoring programme.

