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Research Article

External individual monitoring of radiation workers in Kosovo

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Abstract: Individual monitoring of external exposure for all medical, industrial and research radiation workers in Republic of Kosovo is performed and still is being performed by Institute of Occupational Medicine (IOM). First, film badges dosemeters were used from 1978 to 1982; afterwards individually dosimetry was done based on thermoluminescence detectors (TLD). Nowadays, the service is based on the worldwide known standard thermoluminescence detectors MTS-N (LiF:Mg,Ti), processed in automatic reader Rados RE-2000S. The dosimetry service currently provides individual monitoring of 450 occupational workers in terms of personal dose equivalent Hp(10) and Hp(0.07) for photon fields based in two elements dosimeter. The average dose for occupational worker during last year was 1.73 mSv. Forty-five percent of all individual doses in Kosovo are on the level of natural radiation background and only 6.3 % of Kosovo radiation workers are categorized like exposed workers of category A.

Keywords: individual, monitoring, thermoluminescence, external.

INTRODUCTION

Personal monitoring of workers is required by international documents[1-2] and also by national legislation of Kosovo[3]. Also the dose limits and classification of occupational exposed workers are defined in second legislation in accordance with international legislation, but it is not in force yet.

However, the legislation in Kosovo for radiation protection is still under development. Personal dosimetry for all medical, industrial and research radiation workers are performed by Institute of Occupational Medicine (IOM) which is the only personal dosimetry service in the country. Film badges dosemeters were used for external dosimetry of radiation workers from 1978 to 1980 then thermoluminescence dosemeters (TLD). The new dosimetry system is installed in IOM financed by European Commission through IPA 2009 project entitled "Strengthening the system of dosimetry control for occupationally exposed workers and patients".

This paper presents dose levels of external occupational radiation exposure of different categories from April 2014 to May 2015 of Kosovo radiation workers. From all radiation workers in Kosovo, 93.2 % of them are working for healthcare sector and 77.4% of them in public services. The main aim of this paper is to identify number of exposed workers which belongs to category A are liable to receive an effective dose greater than 6 mSv per year, according to article 40 of Basic Safety Standard[1].

MATERIAL AND METHODS

The RADOS RE2000S (Mirion Technologies) reader was installed with MTS-N (LiF:Mg,Ti) and MCP-N (LiF:Mg,Cu,P), also irradiator IR200 with Sr-90 source was offered. Calibration of TLD system is done by Second Standard Dosimetry Laboratory (SSDL) with Cs-137 source in accordance with ISO-4037[4] and manufacturer's recommendations[5]. External individual monitoring of occupational workers is performed in terms of personal dose equivalent Hp(10) and Hp(0.07) for photon fields based in two elements dosemeter. The TLD dosimeter card consists of a coded slide placed in slide holder. The slide has four positions for detectors. In our case only two positions contain thermoluminescence detectors and one of them is covered by 1 mm Al filters for equivalent dose Hp(10) and no filter is used for skin dose Hp(0.07).

To check linearity of calibrated TLD system a test was performed, 40 dosimeters were collected in four groups and each of them with ten dosemeters, each group was irradiated by Cs-137 source at SSDL with known dose: 0.3, 0.6, 0.9 and 1.2 mSv. IOM processed over 6,000 radiation dosemeters per year. These go to over 172 different employer sites in Kosovo, covering 450 individuals in total (the number of radiation workers is variable during the months). One month monitoring period is applied for all radiation workers and background contribution is subtracted from each value of dosemeter. To each radiation worker was given a personal dosemeter with a unique number assigned to it. The dosemeter is worn on the front at left part of thorax, and on top of the lead apron if it is used.

RESULTS

To check the dosimetry system, a test was done and the results were presented in figure 1. Response of detectors to non-linearity region from 0.1 mSv $\leq$ H $\leq$ 1Sv is within -9% and +11%. So, the system is in line with IEC 62387 standard[6]. Annual average effective dose (AAED) of Kosovo radiation workers is presented in figure 2, the results are obtained from individual dosimeters exposed in 12 months period, based on n = 5386 records from IOM database, which are presented in ten categories. AAED of each category is analyzed separately, for doctors and technicians.

The highest external occupational exposure from radiation workers is observed in nuclear medicine departments with 2.3 mSv/y for doctors and 3.0 mSv/y for technicians, the second category are workers of interventional radiology departments with 2.1 mSv/y for doctors and 2.7 mSv/y for technicians, the lowest dose is taken by workers of dental radiography departments with average dose

1.5 mSv/y. During one year 14 cases were measured with very high dose up to 3 mSv/month, all of them were identified as the accidental exposure of dosemeters, usually dosemeters was forgotten by workers inside of the room where radiation source was installed. Those doses are not taken into account on calculations.

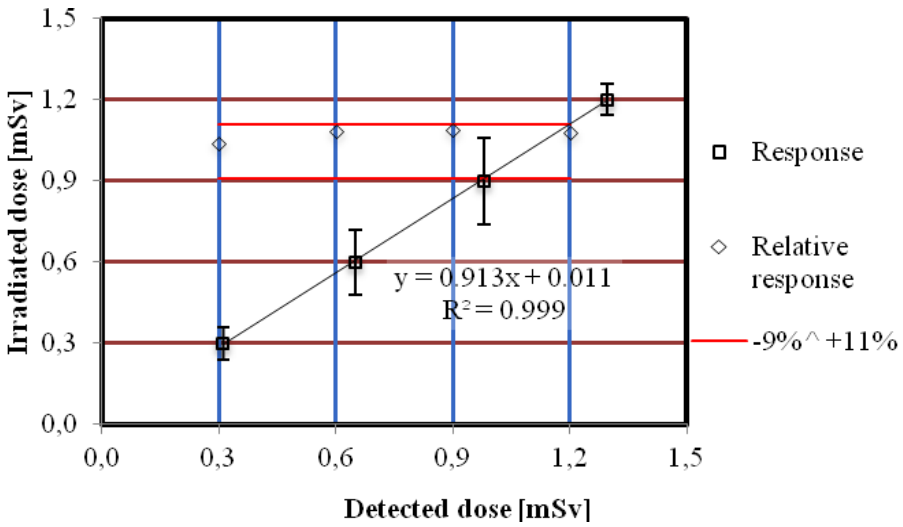


Figure 1: Response of TLD at known dose.

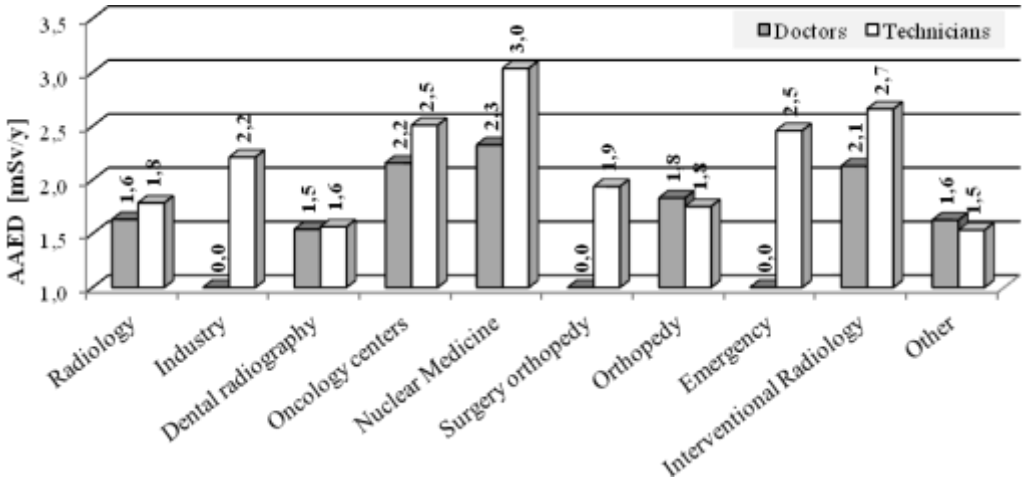


Figure 2: Annual average effective dose of radiation workers in Kosovo

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CONCLUSION

The TLD system fulfills the requirements of IEC 62387 for personal dose equivalent Hp(10) to non-linearity of relative response of dose. The highest annual average effective dose of radiation workers in Kosovo was received by workers of nuclear medicine departments and interventional radiology departments with 2.7 mSv/y and 2.4 mSv/y, respectively. And the lowest annual dose was received by workers of dental radiographic departments. Usually, the technicians have taken higher dose than the doctors of same category.

Only 6.3 % of Kosovo occupational workers are categorized like workers of category A. The annual average effective dose for Kosovo radiation workers is 1.73 mSv/y.
Till now, only whole body dosimetry is performed in Kosovo. Systems for monitoring the doses of extremity, eye and neutron have to be established in near future.

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