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Dosimetry Measurements around the Angiography's Units Using Thermoluminescence Detectors (TLD)

Talaat Salah El-den,Amany .Y.S , M.A.Gomaa
Radiation Protection Department, Nuclear Research Center,
Atomic Energy Authority, Cairo, Egypt

ABSTRACT

The thermoluminescent dosimeters (TLDs) are widely used not only in the field of personnel monitoring (dosimetry) service for ionizing radiation to medical, and research communities, but also for measurements of X-rays emitted from different angiography's unit. Measurements ionizing radiation around the bed area during cardiac catheterization procedures using X-rays was measured. TLD Badges used to determine the annual effective doses, the safe distance for the staff to minimize radiation exposure and the effectiveness of shield and used leaded apron. The results indicated that annual effective dose for by angiography cardiac Catheterization room may exceed the limits.

INTRODUCTION

` The thermoluminescent dosimeters (TLDs) are widely used not only in the field of personnel monitoring (dosimetry) service for ionizing radiation to medical, industrial and research communities, but also for measurements of X-rays emitted from different laser-produced plasmas [1, 2,3] or, for example, a High-Energy Radiation Megavolt Electron Source – Hermes [3] and a Z Facility at the Sandia National Laboratories [5,6].

The advantage of thermoluminescent dosimeters, as detectors of X-ray or VUV radiation from the plasma, lies in the possibility of using them as secondary standards in the calibration measurements of radiation from about 5 eV to tens of MeV.The TLDs can be calibrated with standard radionuclide sources or with a beam of monochromatized synchrotron radiation (MSR) of known intensity. The detection of X-ray radiation by TLDs is affected neither by an electrical interference nor by a strong magnetic field. A large number of TLDs can be simultaneously used in an experiment, but only a single readout unit for determination of their themoluminescent (TL) responses is needed.

The application of TLDs makes it possible only time-integrated measurement of X- rays. Harshow TLD-100LiF:Mg,Ti The thermoluminescent dosimeters (Harshaw). The cardiologist and other staff members are usually working close to the area under examination and receive the dose primarily from scattered radiation from the patient (Fig .1)

Fig.1 Cardiac catheterization procedure with members of staff location

MATERIAL AND METHODS

2.1Thermoluminescent dosimeters (TLDs)

The effective dose for all radiation workers were using (Harshow) TLD-100 LiF:Mg,Ti Harshow chemical, Solon, USA) the TLD card containing Two TLD -100 chips (lithium fluoride) mounted between Teflon sheets on aluminum substrates. The TLD cards were treated at preheat temperature of 150^0 for 5s at a heating rate 15^0C/s up to maximum temperature of 300 C^0. The monitoring of radiation worker in X-ray angiographic cardiac catheterization room was performed at National Heart Institute Cairo – Egypt. Using TLD badge dosimeters. All radiation workers used the TLD underneath the leaded apron at the right side of the chest area as indicator for whole body effective dose.

2.2 Angiography Cardiac Catheterization system

All measurements were carried out in National Heart Institute Cairo – Egypt. Catheterization department, using three X-ray machines (Philips, XRE, and G.E Company)**.** The system used for angiography cardiac Catheterization is of type Diagnostic from Philips. Table (1) represents the technique factors used for performing radiographic examinations of patients.

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Type of X-ray	Output voltage kV_p	Output Current mA
Philips	(55 -100) ± 0.20	150 ± 0.22
G.E	(50 – 95) ± 0.17	104 ± 0.11
XRE	(40- 100) ± 0.25	100 ± 0.15

3. Results and discussion

The annual effective doses received by angiography cardiac Catheterization room are summarized in table (2). Show that the cardiologists are the most exposed persons during angiography cardiac Catheterization procedures, with mean most 4.68 ±0.82, where the nurses are exposed 3.96 ± 0.72 and X-ray Technicians and Pressure Technicians are exposed 2.64 ± 0.55. and 2.04 ± 0.51 These results

indicated that annual effective dose for by angiography cardiac Catheterization room may exceed the limits.

Table (2). Annual effective dose received by personnel of Angiography's Units by TLD Detectors

Personnel	**No. of diagnostic Per month**	**Monthly Effective dose mSv**	**Annual effective dose (mSv)**
Cardiologists	12	0.39 ± 0.82	4.68
Nurses	24	0.22 ± 0.72	3.96
X-ray Technicians	22	0.12 ± 0.55	2.64
Pressure Technicians	30	0.17 ± 0.67	2.04

Table (3) Results of Radiation Measurements Inside Observation Room by TLD Detectors

Location of TLD detectors	Effective dose mSv*
On the separated glass	0.4
On the separated glass (in direction of X-ray tube)	5.0
Right room corner	0.25
Lift room corner	0.37
On the door beside observation room	0.80

*The time of work about 180 h

Table (4) Results of Radiation Measurements Inside Operating Room By TLD Detectors

Location of TLD detectors	Effective dose mSv*
Cardiologist position	18.4
Cardiologist assistant position	11.5
Nurses	2.50
X-ray Technicians	1.90
Pressure Technicians	1.56
In the front of lead apron	13.3
Under the apron	2.80

- The time of work about 180 h

Tables 3, 4 represent the Radiation Measurements Inside Observation Room and Operating Room by TLD Detectors. The shielding efficiency of lead glass beside control table, it reduced the dose to nearly 92% of the initial value. The shielding efficiency of lead apron it reduced the dose to nearly 78.9 % of the initial value

CONCLUSION

The annual effective doses received by angiography cardiac Catheterization room for cardiologists are the most exposed persons during angiography cardiac Catheterization procedures, with mean most 4.68 ± 0.82, where the nurses are exposed 3.96± 0.72 and X-ray Technicians are exposed 2.64 ± 0.55. These results indicated that annual effective dose for by angiography cardiac Catheterization room may exceed the limits. The shielding efficiency of lead glass beside control table, it reduced the dose to nearly 92% of the initial value. The shielding efficiency of lead apron it reduced the dose to nearly 78.9 % of the initial value

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