

Current status of individual dosimetric monitoring in Senegal



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ABSTRACT

In Senegal, workers exposed to ionizing radiation are increasing every year. To facilitate access to dosimetric monitoring of workers exposed to ionizing radiation, the “Autorité sénégalaise de Radioprotection et de Sécurité nucléaire” (ARSN) has set up, since November 2014, an external dosimetry laboratory. We used the Landauer’s OSL microstar reader based technology to study and describe the current situation of individual dose exposition of 700 workers in both the medical and industrial sectors.

The analysis of the external exposure by field of activity have also been studied. Results have shown that the average annual effective dose is 0.46 mSv in the medical sector and 1.10 mSv in the industrial sector. Globally, these results show the average annual effective dose is stable and demonstrate the potential of OSL dosimetry system to promote a more comprehensive personal monitoring service for OEWs.

MATERIALS AND METHODS

This study was carried out over one year by monitoring occupationally exposed individuals working in medical and industrial facilities. Each worker was assigned one OSL dosimeter for one quarter or one month with a personal identification number (ARSN CODE). Radiation safety officers were provided with dosimeter user instructions that included details on strict adherence to wearing of OSL badges on the upper torso, between the neck and waist, and outside protective gear when undertaking exposure-related activities. Facilities management assigned one person to deliver the dosimeters for monthly reading or quarterly reading and collection of newly annealed OSL badges. Natural background radiation levels from control OSL samples were used to correct for the actual individual dose received by each worker.

In this work, we used a Landauer’s OSL microstar reader. Based on OSL technology, the emitted light by the OSL detector after stimulation by light emitting diodes is proportional to its exposed irradiation dose. Using this technology, individual dose expositions of workers in the medical and industrial sectors has been measured and compared. The medical sector is composed of the following field of activities: medical radiology, radiotherapy, nuclear medicine; while the industrial field includes the following activities: non-destructive testing, calibration, thickness or level gauges, gamma densitometers, etc...

Dosimeter read-outs were done at the Laboratory of dosimetry, located at the ARSN.

For penetrating external ionizing radiation, personal deep dose equivalent (which is scientifically recommended for operational deep dose quantity) was adopted in this study. The measured dose and details of the data collected were entered into an Excel spreadsheet for analysis. The collective effective dose was estimated from the number of monitored persons multiplied by the average effective dose.

Table 1 : Results of dosimetric monitoring (exposure to photons)
according to the field of activity.

Field of activity	Workforce monitored	Collective effective dose (man.mSv)	Mean individual effective dose (mSv)	Workforce breakdown by effective dose class					
				< Threshold	Threshold to 1 mSv	1 to 5mSv	5 to 10mSv	10 to 20mSv	>20mSv
Medical field	511	235	0.46	277	174	60	0	0	0
Industrial field	189	208	1.10	97	49	27	14	2	0

Figure 1 workforce by sector

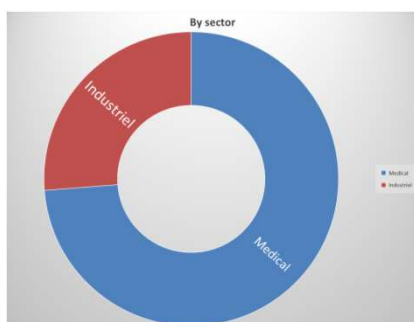
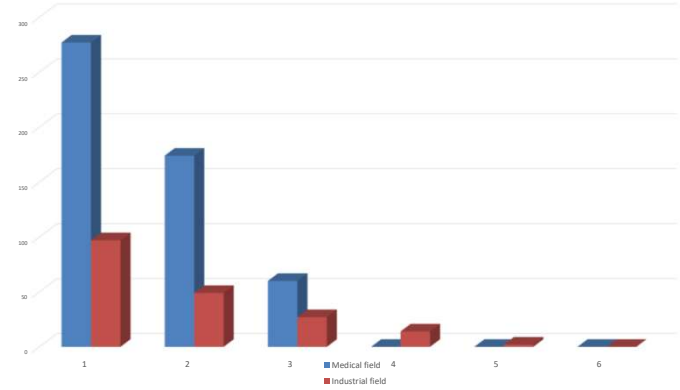


Figure 2 Workforce breakdown by effective dose class and field of activity



RESULTS AND DISCUSSIONS

Table 1 summarizes dose measurements from monitoring occupationally exposed individuals working in medical and industrial facilities; while Fig. 1 shows the distribution of the workforce by area of activity: medical activities are the majority (74% of the workforce), and industrial activities represent 26% of the workforce.

Fig. 2 represents the distribution of workers by dose class, it shows that the majority (90%) of the workers monitored did not record an annual dose greater than 1 mSv. Workers who received a dose greater than 1 mSv represent 10% of the total monitored; whereas those who recorded a dose above the threshold represent 20% of the total monitored. No worker has received a dose greater than 20 mSv, all areas combined.

For all the subjects monitored, measured doses were well below the internationally recommended limit of 20 mSv per year.

Annual average occupational dose value in Senegal in the year 2021, for the medical field, is compared to that reported in the year 2020 [4]; which was 0.52 mSv. This measured value is very close to the measured annual average occupational dose in 2021 (0.46 mSv).

CONCLUSION

In this work, we studied and described the current situation of individual dose exposition of 700 workers in both the medical sector and industrial sector. The analysis of the external exposure by field of activity have also been studied and results have shown that the average annual effective dose is 0.46 mSv in the medical sector (80% of the total monitored) while in the industrial sector (20% of the total monitored) that average is 1.10 mSv. Results from this study contributes to the existing works to promote a more comprehensive personal monitoring service for OEWs. The continuous analysis of occupational doses should be an integral component of institutional radiation safety programs in SENEGAL.

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