IAEA-CN-67/96

DOSIMETRIC MONITORING BY THERMOLUMINESCENT DOSEMETERS OF EMPLOYERS WORKING IN IONISING RADIATION FIELDS

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ABSTRACT

Radiation Protection Commission was established in the Ministry of Health and Environment as Regulatory Authority, organises and supervises all activities related with radiation protection, as the licensing, inspection, dosemetric personal control, medical examination,radioactive waste management,etc.

Actually in our country are exerting some activities,which intend to covert the principal tasks in the field of radiation protection. Such activities are dosemetric personnel control based on TLD, radioactive environmental monitoring, radioactive waste management, calibration of dosemetric equipment's etc.

This paper describes the realisation of personnel monitoring by thermoluminescent dosemeters TLD -100 chips and cards were furnished by IAEA some years ago. Various experiments to determine the dependence of the response of dosemeters versus dose and versus orientation, the fading and lower detectable dose. The personnel monitoring of workers that work in ionising radiation field were in charge o f Institute of Nuclear Physics (INP). Actually in Albania was established the personnel monitoring service for employers of INP, Oncological Centre, Nuclear Medicine Centre and some other nuclear units in Tirana city.On the near future year exists the possibility to extend personnel monitoring for all physicians and technicians of rontgendiagnostic units of Durres,Shkodra,Elbasan cities.

RADIATION PROTECTION ORGANISATION

Albania is a small country, with no nuclear power industry and also not involved in a large scale with ionising radiation's.

The establishment of a proper radiation protection system requires following elements: legislation, administrative mechanism, qualified personnel and dosemetric equipments.All these elements exist actually in our country, but their efficiency is not fully sufficient.

Radiation Protection activities started at the same time with the beginning of use of radiodiagnostic devices in health field,but realistic conditions were created after setting up of some nuclear units in medicine,industry,agriculture and finally with INP in 1971 year.

The first Law on Radiation Protection in Albania has been set out 26 years ago by a special Ordinance of Ministers Council Law No. 83, date27.05.1971.In the new Law No.8025, date 9.11.1995 defines radiation protection terms for all activities, performed with radioactive materials and radiation devices, providing safety of the workers professionally exposed, population and environment as a whole from eventual detriments of ionising radiation[1]. Other act in this law describes also the general rules for production, use, transport, storage and disposal of the radioactive wastes and spent radiation sources.

A Radiation Protection Commission was established in the Ministry of Health and Environment as Regulatory Authority for the organisation and supervision of the all activities related with Radiation Protection problems[1].

In collaboration with the Institute of Public Health (Office of Radiation Protection), Institute of Nuclear Physics the Commission of Radiation Protection control all activities in Radiation Protection field.

The Institute of Nuclear Physics (INP) in Tirana is the focal point for the transfer,uses and implementation of nuclear techniques in the country, including research activities in different fields: radiation protection service, radiological environmental monitoring etc.

ASSESSMENT OF INDIVIDUAL EXPOSURES

a- Control of doses of the workers by TLD.

The Radiation Protection Division in INP, carries out all the personnel monitoring activities for our country, Albania. Actually this control fulfilled for about 300 workers, based on TLD (LiF, TLD-100 cards) furnished by IAEA. Nearly half of the monitored persons are employers in the medical field in Tirana and Durres cities.

TLD-100 is produced by homogeneous melting of lithium fluoride,magnesium fluoride, lithiumcryolite and lithium titanium fluoride, resulting in a phosphor containing 300 ppm magnesium and 20 ppm titanium. A single crystal is solidified from the melt, then pulverised, and the powder grains sieved and separeted.Personal dosimeters TLD are worn on the trunk of the body at chest level where the dose is likely to have its maximum value while the reading of the dosimeters is taken to correspond to whole-body dose with assumption that the body is uniformly irradiated. Actually we haven't made any correction for non-uniform exposure or to apply convertation factors[2]. We have tried to use extremity dosimeters to a small proportion of workers in the Oncological Hospital to determine the value of dose exposure there. Plastic sachets in ring form with a solid TLD worn on a finger supplied by IAEA after being exposed during work in a month period.Neutron dosimeters are worn by a small group workers of the Neutron Physics Division in our Institute and Oil Enterprise in Fier city. In all cases dosimeters were issued regularly for a period of one month[2].

The TLD system is based on a HARSHAW-4500 reader now in operation one year. 7 years ago we have used a HARSHAW-2000 reader and during this period, the maximum annual individual dose was below 4.25 mSv. Some of the monitored employers have received month dose below the lower detection limit (0.1 mSv). These doses are quoted as zero.The record of data regarding with individual monitoring are kept regularly and we have made a Regional Worker Dose Registry,which contains information relevant to radiation protection for each employer that works in ionising radiation field.

Albania meets a difficult problem related with medical exposure of the populations a result of the old age of X-ray units in the country, a great concern exists for radiation of both categories of practitioners and technicians and population in whole related to high level of exposure during different radiodiagnostic procedures.For improvement of this problem it is foreseen a QA programme in medical field as well as the reviewing of the possibilities for gradual replacement of old X-ray units for medical purposes.

b. Environmental Monitoring

An important problem is the monitoring of environmental radioactivity.The control of environment fulfilled for two motive: radiation protection of environment from different radioactive contamination and estimation of doses of the population. The Basic Safety Standards define permissible levels of exposure and derived limits.There are three categories of people according to the levels of exposure:

Category A- a personnel,temporary or permanently working in field of external and/or internal exposure 50 mSv.

Category B- some part of population older than 18 years with limit of 5 mSv,(people that live near the nuclear facilities).

Category C- the whole population of the country with limit of 0.5 mSv [1].

Some Institutions and Centres in a national network co-operate together for realisation of the environmental monitoring.This monitoring is done through the sampling of atmospheric fall-out and air filtration,taken from three small stations that cover all territory of our country.

Samples of soil from a depth of 10 cm and from surface ground are taken every quarter in the vicinity of INP for four direction of horizon.For all the samples a total beta measurement is done. All values are registered and are comparable with those published elsewhere.INP also performs the control of eventual radioactive contamination of certain foodstuffs [3].

With the increasing application of the thermoluminescent dosemeter (TLD) in environmental monitoring, some attempts have been made in our country to establish minimum acceptable performance criteria for TLD systems. In addition to the use of TLD for personal dosimeter and for radiation-area monitoring , since radiation from man-made sources is superimposed upon the natural environmental radiation,thermoluminiscence dosimeter is also attractive for surveying the radiation levels in the vicinity of nuclear facilities.From six years the monitoring of environmental radioactivity near the INP is done on a routine basis. Crystals of CaF_2-Dy (TLD-200 chips) are used with the HARSHAW reader[4].

Data from the control samples collected at the surroundings of INP have shown that the general radioactivity level and the content of radionuclides are within the limits of tolerance and tent to decrease.

MATERIALS AND METHODS

In our country the individual monitoring of external exposure was carried out by using film badge dosemeters until 1990. Actually the individual monitoring to be performed with TLD-100 cards,given by IAEA, was established.Every month the Dosemeters Service Division on INP distributes around 250-300 pieces TLD badge dosemeters for measurement of effective dose, of nuclear units in Tirana and Durres .The characteristics of commercial "whole-body" dosemeters utilized,such as the procedures of calibration and methods for dose assessment are presented. Two reference methods for determination of the dose were applied,one in which

TABLE 1 Mean Annual Effective Dose for workers of Tirana city

No.	Occupational Practices	Mean Annual Effective Doses (mSv)		
		1995	1996	1997
1	Military Hospit.	0.25	0.35	0.95
2	Hospital No.1	0.45	0.5	0.35
3	Hospital No.2	0.45	0.82	0.55
4	Hospital No.3	0.3	0.5	0.45
5	Hospital No.4	0.3	0.35	0.3
6	Hospital No.5	0.35	0.3	1.5
7	Ptisio-Pneum. Hos.	0.4	0.45	-
8	Disp. anti TBC	0.6	0.55	0.3
9	Nuclear Medicine	0.39	0.65	0.45
10	Reg.Polyclin.No.2	3.5	1.9	1.3
11	Reg.Polyclin.No.3	0.45	0.45	0.35

TABLE II Number of persons working with Ionising Radiation in Albania.

Medical	Research/Teach.	Veterin/Agricult.	Industry	Total
600	150	100	150	1.000

dosemeters for calibration,irradiated with Cs-137 (activity A=30 mCi) are used, and another in which two sets of dosemeters were employed for calibration, one irradiated with Cs-137 source and other one with a Am-241 source (activity A=100 mCi) [1].In table I are given mean annual effective dose, mSv for workers of nuclear units of Tirana city.

RESULTS

In the Dosemeters Service Division on INP, values of annual mean effective dose for occupational practice (Table I) evidence that practices with largest mean doses for external irradiation are those of Regional Polyclinic No.2, Hospital No.5,and Military Hospital,but underline that in no case exceeds 5 mSv.

During the last year (1997) the higher value of annual effective dose was registered for Military Hospital,Hospital No.5, and Regional Polyclinic No.2 (1995,1996,1997)

The percentage of workers which received doses lower than that value,is in all practices,around 95%.

The frequency of cases above 5 mSv oscillate between 3-5 workers,but underline,these situations are negligence of workers,after they have forgot dosemeters on the ionising fields. It results that technicians of Regional Polyclinic No.2 with high level of exposure doses,as a result of the old age of X-ray units and bad conditions on work places.

CONCLUSIONS

For all occupational practices the current system of dose limitation established in Albania with 50 mSv as limit of annual dose is satisfied.

To extend personnel monitoring with TLD-dosemeters for all physicians and technicians of rentgennodiagnostic units of Durres,Shkodra,Elbasan,Fieri cities.

To create the Radiation Dose Registration Centre and National Worker Dose Register for workers designated by CRP near the INP,extending personnel monitoring all over country (about 1000 workers), IAEA has supplied our Institute with 1500 pieces TLD-cards and badges.Table II given number of persons working with ionising Radiations in Albania.

REFERENCES

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