# IONIZING RADIATION SOURCE DETECTION BY PERSONAL TLD

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**SUMMARY**

The Laboratory for personal dosimetry has about 3000 workers under control. The most of them work in medicine. Some institutions, as big health centers, have different ionizing radiation sources. It is usefull to analize what has been the source of irradiation, special when appears a dosimeter with high dose.

Personal dosimetry equipment is Harshaw TLD Reader Model 6600 and dosimeters consist of two chips LiF TLD-100 assembled in barcoded cards which are wearing in holders with one tissue-equivalent filter (to determine H*(10)) and skin-equivalent the other (to determine H`(0.07)).

The calibration dosimeters have been irradiated in holders by diferent sources: x-ray (for 80keV and 100keV), $^{60}Co$, $^{90}Sr$ (for different distances from beta source) and foton beem (at radiotherapy accelerator by 6MeV, 10MeV and 18MeV).

The dose ratio for two LiF cristals was calculated and represented with graphs. So, it is possible to calculate the ratio H*(10)/H`(0.07) for a personal TLD and analize what has been the source of irradiation.

Also, there is the calibration for determination the time of irradiation, according to glow curve deconvolution.

**EQUIVALENT DOSES AS SOURCE INDICATOR**

Personal dosimeters have two chips: one which is irradiated under tissue-equivalent filter and calibrated to determine H*(10) and the other which is irradiated under skin-equivalent filter to determine H`(0.07).

The dosimeters have been irradiated in holders with diferent sources: x-ray (for 80kV and 100kV), $^{60}Co$, $^{90}Sr$ (for different distances from beta source) and foton beem (at radiotherapy accelerator by 6MeV, 10MeV and 18MeV).

The dose ratio H*(10)/H`(0.07) for different sources and energies was calculated and represented with graphs. The Figure 1 represents ratio H*(10)/H`(0.07) for different x (or gamma) ray sources. Five or more dosimeters were irradiated by different energy and the average value is given on the graph. The Figure 2 gives Log [H*(10)/H`(0.07)] for $^{90}Sr$ (for different distances from beta source in the air).

Figure 1: The dose ratio for TLD with two chips LiF exposed in Harshaw holders to x (or gama) ray

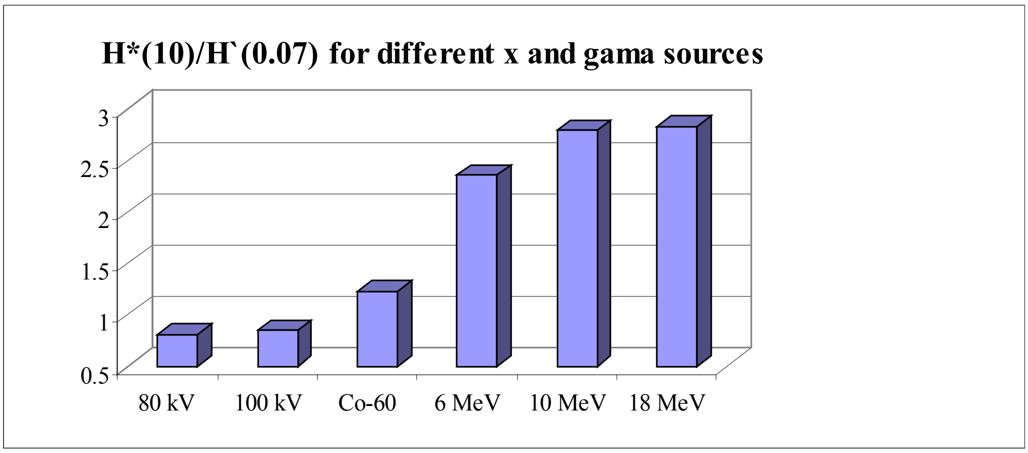
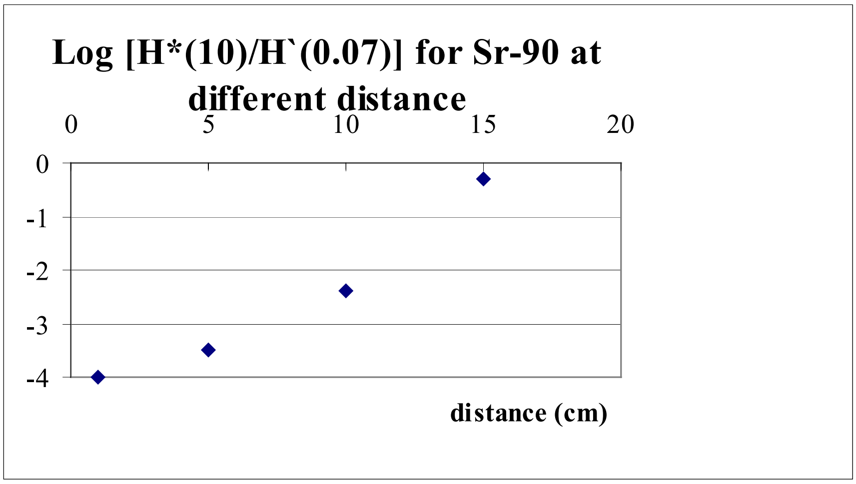



Figure 2: The dose ratio for TLD with two chips LiF exposed in Harshaw holders to $^{90}Sr$

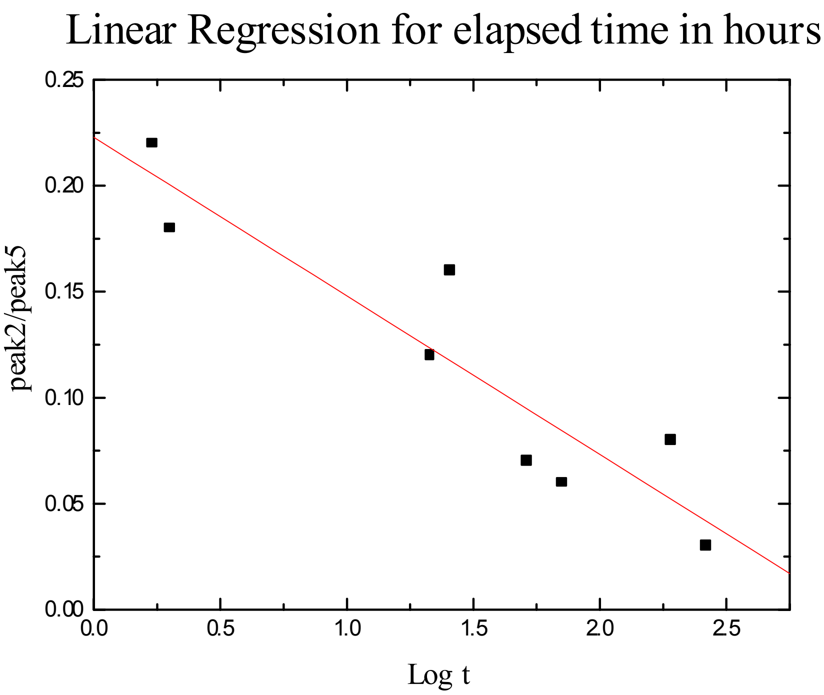



**DETERMINATION OF IRRADIATION MOMENT**

Thermoluminescent dosimeter LiF has four peaks ($2^{nd}$, $3^{rd}$, $4^{th}$ and $5^{th}$) importan for personal dosimetry analysis. The first peak has too short half-life so, it is out of interest .

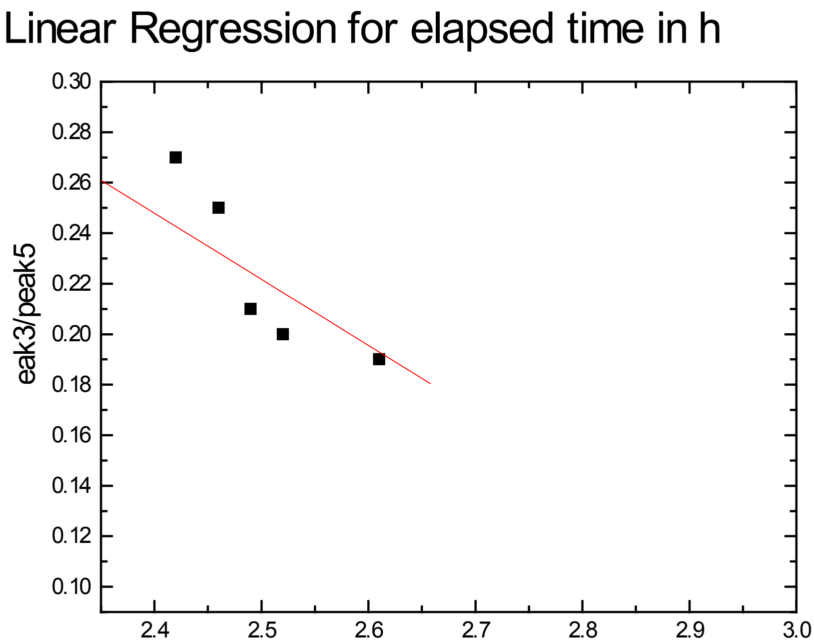
There were examined (by Harshaw Computerised Glow Curve Deconvolution Program) glow curves for 125 dosimeters one-shot exposed to x-ray. Liner dependence *Log T* (*T* elapsed time) and ratio *peak2/peak5* (also *peak3/peak5*) is given on Figure 3 and 4.

Figure 3: The ratio peak2/peak5 according elapsed time




| | |
|---|---|
| y = a + xb | |
| a = 0.22 | sd. 0.02 |
| b = - 0.075 | sd. 0.13 |
| SD = 0.02762 | N=8 |
| R = - 0.92 | |
| P = 0.00109 | |

Figure 4: The ratio peak3/peak5 according elapsed time




| | |
|---|---|
| y = a + xb | |
| a = 0.88 | sd. 0.08 |
| b = - 0.26 | sd. 0.03 |
| SD = 0.01684 | N=8 |
| R = - 0.94 | |
| P = 5.0998 E-6 | |

**DISCUSSION**

As much as it is important to estimate effective dose sometimes it is very important to estimate the irradiation moment and the source of irradiation.

The calibration graphs (figure 1, 2, 3 and 4) are used in this Laboratory to estimate the irradiation conditions.

Of course, it is not possible always. One-shot exposure could not be detect after more than 1000 hours. (For example, personal dosimeters of workers clasiffied as B category are read-out once in three mounths.)

The legal regulations in Yugoslavia define two categories of occupational exposed persons as A and B category. Personal dosimetry is obliged monthly (for category A) and once during three months (for category B). Monitoring of the workplace is done by authorized institutions once a year (for the most sources). The effectiv dose for a worker will exceed defined limit if an accident would be happned. So, it is very important to estimate the time of irradiation. It is possible to detect one-shot irradiation only if it was happened inside period of about one tousand hours before read-out moment.

If personal dosimeter is analyzed once in three mounths, it is impossible to detect one-shot irradiation in the first half of detection period.

## CONCLUSIONS

We suggests more than two categories of occupational exposed workers; individual external monitoring monthly for some categories and only monitoring of workplace for some kinds of ionizing radiation exposure. Personal dosimetry which is read-out once in three months is not very usefull. Only effective dose can be estimated, but as a rule it is very low dose and individual external dosimetry is not necessary.


### ACKNOWLEDGEMENTS

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## REFERENCES


[1] Marinkovic, O., Determination of Irradiation Moment with TLD Type LBG-0110, I Regional Symposium: Chemistry and the Environment, Vrnjacka Banja, Proceedings (1995) 1024-1027.