PROBLEMS OF NEUTRON PERSONNEL DOSIMETER AT KEK

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Introduction

In the counter experiment hall at KEK, dose equivalent (D.E.) is due to neutrons, gamma-rays and other charged particles. Neutron component is, however, most dominant and 3 ~ 10 times larger than that of gamma-rays. Film badges (Kodak neutron film type A) are used for personnel fast neutron monitoring. But there are some problems in the film badge method, so recently an albedo neutron method is used with ^{6}Li and ^{7}Li thermoluminescent dosimeters (Matsushita UD-136N, 137N). These two results were compared for some radiation workers.

Results and Discussion

Film badges are calibrated using ^{241}Am-Be neutron standard sources. But stray neutron spectrum at KEK are different from that one, so film badges were exposed at several positions in the counter experimental hall. D.E. measured by film badges were compared with "true dose equivalent".

"True D.E." was measured using ^{11}C activation detector and neutron "rem counter" (Studsvik 2202D). ^{11}C activation detector utilized $^{12}C(n, 2n)^{11}C$ reaction for the measurement of neutrons with a threshold of $E \geq 20$ MeV and "rem counter" measures neutron D.E. at the energy below about 20 MeV. True D.E. means the sum of these two D.E.

The ratio (measured D.E.) : (true D.E.) is shown in Fig. 1 as a function of the ratio (^{11}C detector (> 20 MeV)) : (rem counter (< 20 MeV)). As a whole film badges overestimate the D.E. more than factor 2. As the neutron spectrum becomes harder, measured D.E. by film becomes larger and on the contrary that by TLD becomes smaller. Next, track fading of film in July is shown in Fig. 2. When a temperature is high, about 40 % of tracks are lost after 2 weeks.

Several groups of radiation workers used films and TLD for a month. In Fig. 3 the relation between these two results is shown. To determine D.E. using TLD, the average conversion factor shown in Fig. 1 was used. Usually the ratio (D.E. by UD-136N) : (D.E. by 137N) was 2 : 1. As a whole the results by films are in safety side. But they are in agreement with that by TLD within about factor 2.

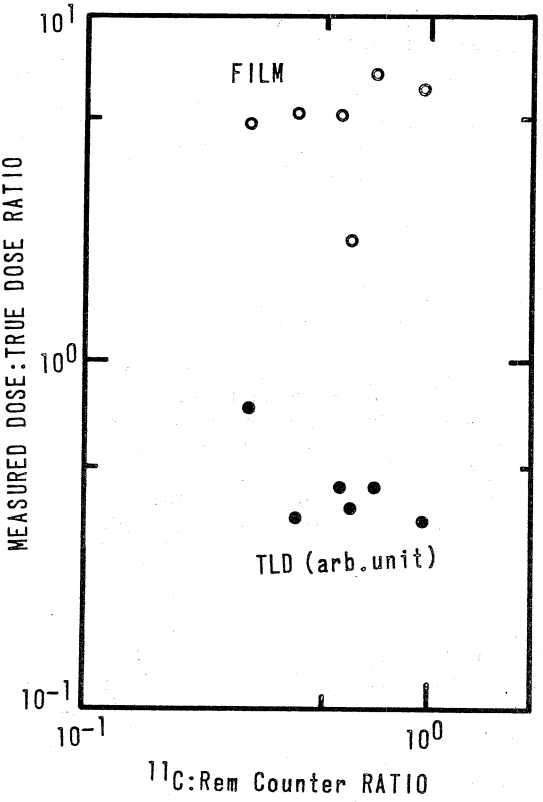

Fig. 1. Measured dose: True dose ratio

Film and TLD response are shown as a function of spectrum index (^{11}C/rem counter ratio).

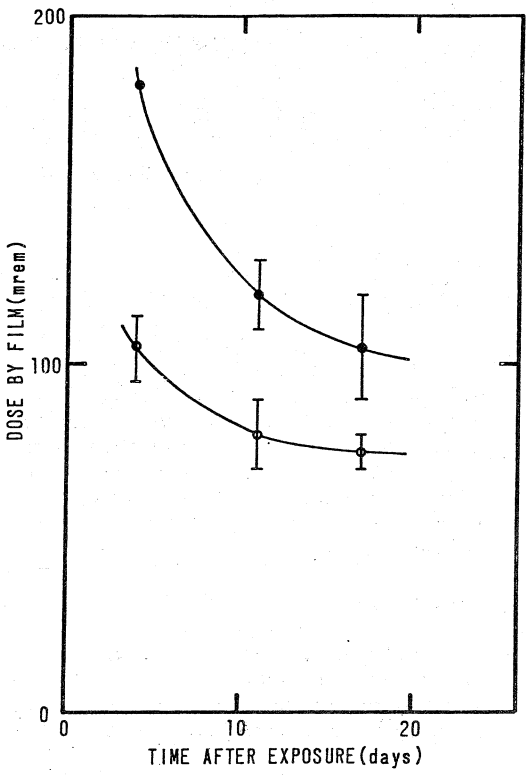

Fig. 2. Fading of film tracks

They are storaged indoors in July at KEK after exposure.

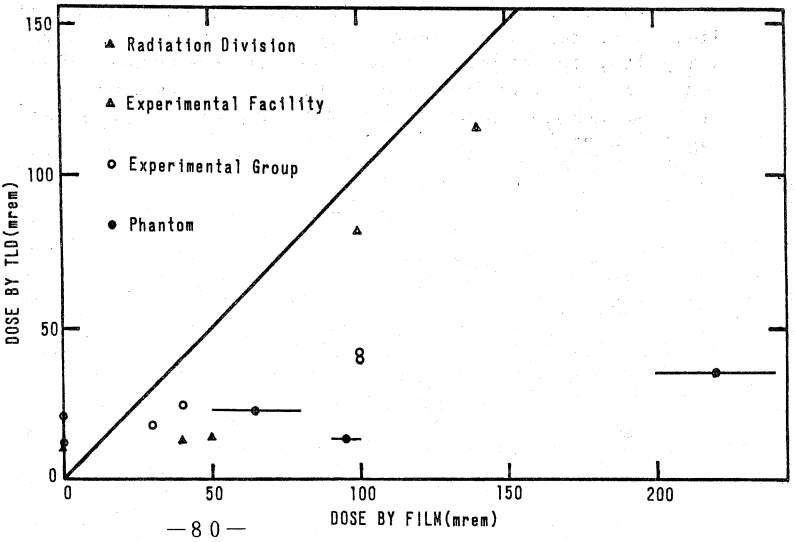

Fig. 3. Dose by Film VS Dose by TLD

Several groups of radiation workers used films and TLD for a month. But phantom was exposed for within 2 days.