

§1. Application of EPD to Environmental Radiation Measurement

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The continuous measurements of environmental radiation have been conducted by means of thermoluminescence dosimeter (TLD) or radio-photoluminescence dosimeter (RPLD) in Toki area since 1986. The electrical personal dosimeter (EPD) is used for measuring dose of radiation workers in these days. Some EPD has an enough sensitivity to measure the natural background gamma radiation, and has a stability to long period monitoring. Therefore, it can be applied to an environmental radiation monitoring. The EPD has another advantage for small-scale monitoring on its cost because it does not need an expensive readout device. And, it has an excellent point to obtain the trend of dose rate.

It is expected that the EPD is applied to the environmental radiation measurement. On that situation, it is necessary to clarify the difference between EPD and TLD or RPLD. In this study, EPD and RPLD were set at the same place more than one year in order to compare the sensitivity of these two. EPD-Mk2 which is ThermoElectron's product was used as EPD. SC-1 produced by the Asahi techno glass was applied as a RPLD. RPLD was set three detector pieces as one set at one monitoring point. The one set of dosimeters, one EPD and three RPLDs, was put in a simple instrument shelter. The total number of the measurement points is 21. These are 7 points in the site of the NIFS, 7 points in Toki City, 6 points in Tajimi City, and one in the lead box thickness of 5cm (in Pb5cm). The measurement started on March, 2006. One measurement period was three month, after the exposure the dosimeters were exchanged the new one. A lithium battery is used for EPD. It can be used for more than 3 month. There was only one time of the power supply loses during four times of three months measurement in 21 places. Even if the power supply loses, the measured dose data can be preserved at that moment. Therefore, the dose rate before the loss can be obtained.

Figure 1 and 2 show examples of the measurement result. The annual dose obtained for the measurement is a range of 0.2 - 1.2 mSv/y. The relationship between RPLD and EPD has linearity in dose rate. The dose rate measured by EPD was larger than that by RPLD. The difference of the sensitivity appears in two points. The one is caused by self-dose and cosmic rays. It corresponds to measurements in Pb box. The other is due to the difference of sensitivity to environmental gamma rays. The dose rate 0.02 - 0.03μSv/h and 0.02μSv/h was obtained respectively as measurement results of EPD and RPLD set in the lead box 10cm thickness for three months. These values were almost the same as the measured value set in Pb5cm within measurement error. Therefore, the measured value in Pb5cm can be used for discussion of the amount of self-dose and dose due to cosmic rays, when

EPD is compared with RPLD. The difference between EPD and RPLD remains after considering with the value due to self-dose and cosmic rays. This is a systematic difference since the correlation coefficient of the regression line was 0.98 high as shown in Fig. 1 and Fig. 2. It is thought that this is caused by the difference of sensitivity to gamma rays. It is necessary to clarify the calibration factor of each EPD and to correct the sensitivity.

The sensitivity of EPD was compared with that of RPLD in the environmental radiation measurement more than one year. The dose rates measured by these two have good linearity and high correlation. However, an appropriate correction to EPD is required for application to environmental monitoring because there are some differences of sensitivity with RPLD.

When an abnormal data would be obtained by means of one dosimeter, we could identify merely that some trouble had occurred. However, two types of dosimeter would be used for the one measurement, we could discuss the measured data quantitatively. It is thought that it is significant that EPD is applied to the environmental radiation measurement in this sense.

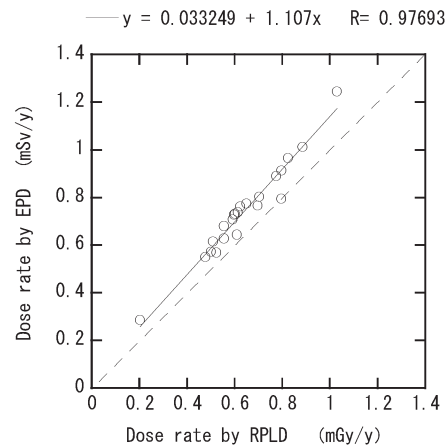


Fig. 1 Comparison of dose rate EPD and RPLD (June – September, 2007)

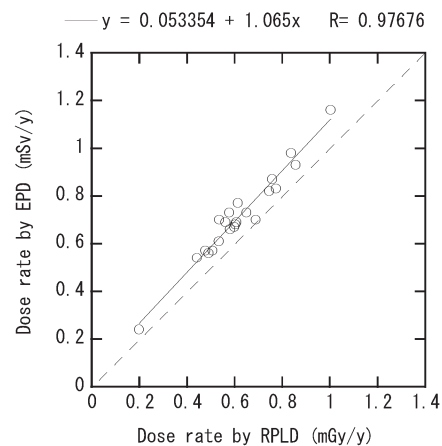


Fig. 2 Comparison of dose rate EPD and RPLD (September - December, 2007)