# DOSE MEASUREMENT AND ITS PROBLEMS ON THE HIGH BACKGROUND RADIATION AREA(HBRA) IN CHINA

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## INTRODUCTION

As a part of China-Japan cooperative research on radiation epidemiology, we carried out dose-assessment study in the HBRA since 1991 to 1994. Particularly, we have examined quantitatively on the characteristics of distribution of the numerical measurements and analyzed the variables concerned, using different kinds of dosemeters in order to obtain the information with regard to accuracy of the data for dose estimation. We selected for the dose measurement, 陽東県 and 陽西県 as the HBRA and 恩平県 as the CA.

## INHOMOGENEOUS SPATIAL DISTRIBUTION OF RADIATION EXPOSURE IN THE HBRA

Average dose rates for indoor and outdoor in different hamlets of the HBRA measured by NaI (Tl) scintillation survey meter (TCS-166) are shown in **Figure 1.** It was remarkable that indoor dose rates were about 2 times higher than those of outdoor, although the ratios of the dose rates between indoor and outdoor in the CA were not so remarkable, rather almost similar. Further study showed that the dose rates of indoor had a good correlation with the dose rates of the house wall, and decreased with increase of the distance of the measured site from the house wall. These results strongly suggest that levels of radionuclides containing house wall will be deeply concerned with the radiation dose exposed. Thus, we have performed radionuclide analysis of the building materials such as bricks, tiles and soil samples using Ge-semiconductor diode detector. Nuclides of Th-232 decay products in the HBRA were 3-4 times higher than those of the CA. Similarly the decay products of Th-232 in the HBRA were about 2 times higher than those of U-238. These results were verified the data obtained by Chinese investigators. We have further measured personal doses with PDMs and TLDs for 24 hours and 2 months respectively. It was obvious that there were good correlation between personal radiation dose rates and indoor dose rates. Personal dose rates largely depends upon exposure dose rates originated from radionuclides in building materials of house.

## VARIATION OF THE EXPOSED PERSONAL RADIATION DOSE RATES WITHIN A HAMLET

We have examined variation of the indoor dose rates of 32 different houses within a hamlet of 牛根 . We observed there were fairly large variation of the indoor dose rates with different houses in a same hamlet, presumably due to the different housing conditions such as levels of

radionuclides of the building materials and spatial location in a hamlet. It should be noted that this range of variation on the indoor dose rates was almost comparable with those of distribution of different hamlets in the HBRA as shown in **Figure 2.** Further we have examined variation of personal dose rates measured by 96 TLDs as well as PDMs in a hamlet of 麻地. Fairly wide range of variation for personal dose rates within a hamlet demonstrated in **Figure 3.** This wide range of distribution for personal dose rates is considered to be due to, at least, two kinds of independent factors;
1) different levels of indoor dose rates with houses and 2) different personal behavior which is reflected as an occupancy factor.

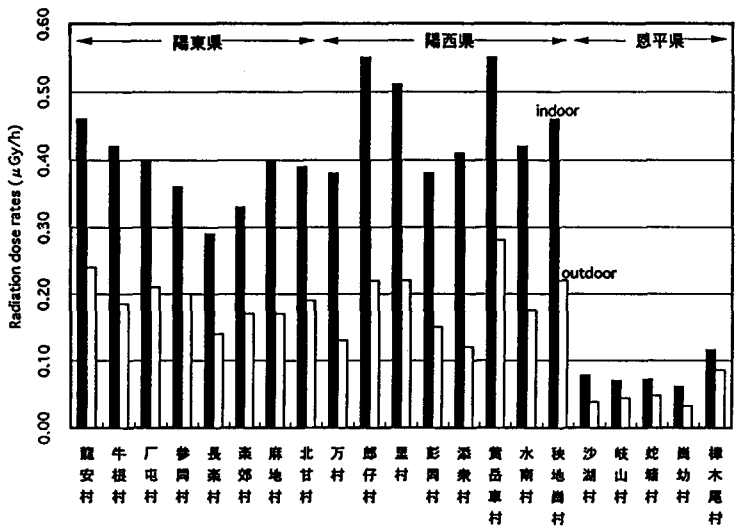


Figure 1. Variation of the mean environmental radiation dose rates on the HBRA (measured by TCS-166).

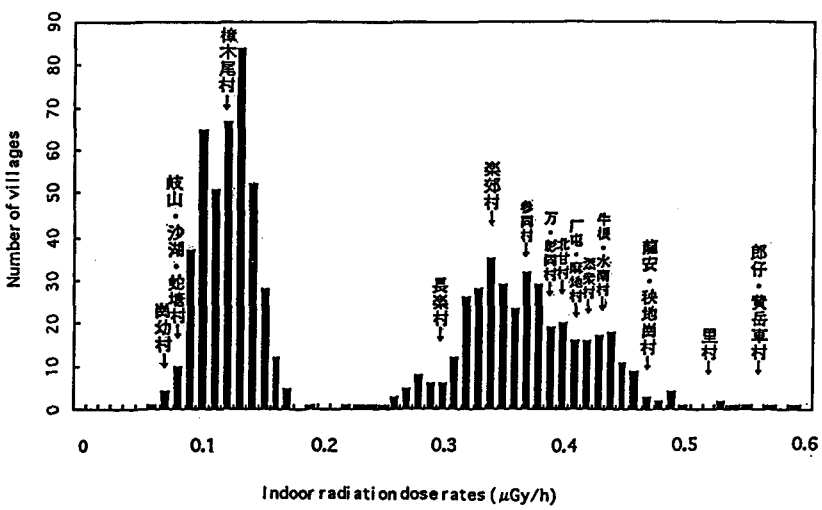


Figure 2. Frequency distribution of indoor radiation dose rate on HBRA (measured by survey meter).

# VARIATION OF OCCUPANCY FACTORS CONCERNED AND ESTIMATION OF PERSONAL DOSE RATES

We have three models for personal dose measurement. They are two direct methods using electronic pocket dosimeter(PDM-101) and thermoluminescence dosimeter(UD-200S) and indirect method. The different approaches will be undertaken; direct methods and indirect method by using occupancy factor. In direct approach to estimate personal dose rates with hamlet population, since the difference between indoor dose rate and outdoor dose rate is so large, personal exposed dose rate depends upon their living life style which is related to occupancy factor i. e., ratio of the resident time on indoor per one day. This relation will be shown as following equation;

$$Dp=Di(q) + Do(1-q), \quad q=(Dp-Do)/(Di-Do)$$

where Dp, Di, Do and q are personal dose rate, indoor dose rate, outdoor dose rate and occupancy factor, respectively. Thus we can estimate personal dose rate if the values of Di, Do and q are given.

Coefficient q value of occupancy factor could be estimated by different two ways;
1) Indoor occupant time is available by direct measuring using the method of questionnaires and 2) Effective occupancy factor which is estimated from equation mentioned above and known values of Dp, Di and Do.

As it is impossible to measure the personal dose rate directly for everyone and them we will estimate indirectly using the measured environmental radiation dose rates. Further study to elucidate a nature of occupancy factor in various conditions is needed. And we should be carefully applied the occupancy factor for estimation of personal dose rates in hamlet population.

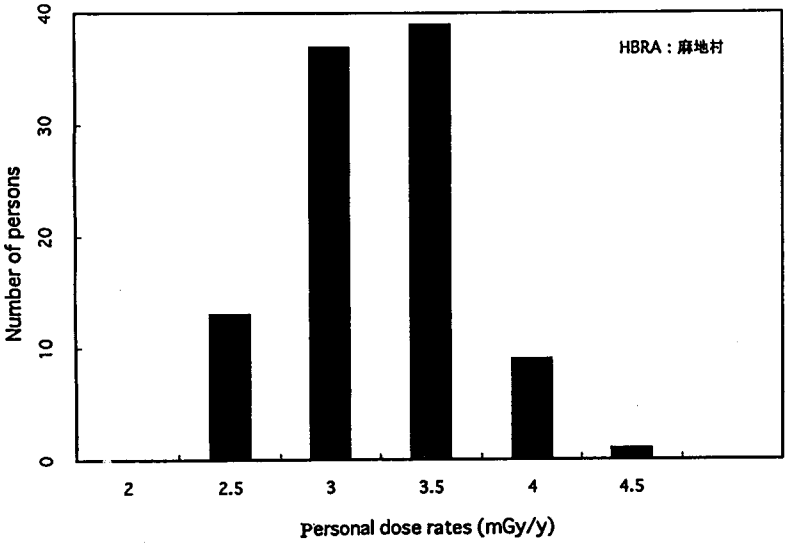


Figure 3. Frequency distribution of personal dose rates in a hamlet of the HBRA (measured by TLD).