

CHARACTERISTICS OF RADIATION FIELD IN LIVING SURROUNDINGS AND IN NATURAL ENVIRONMENTS

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INTRODUCTION

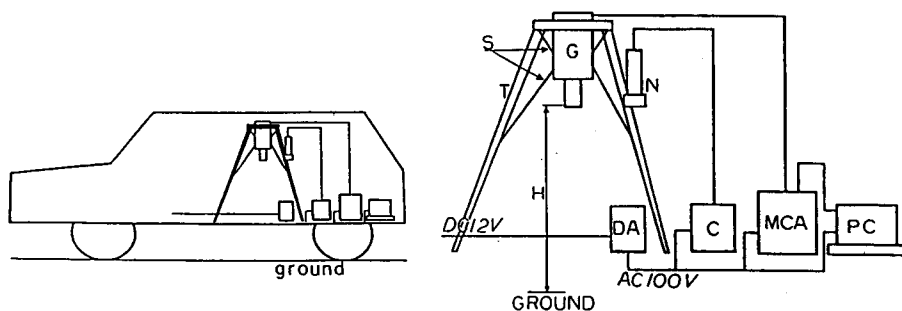
Levels of environmental radiation vary upon the environmental conditions and have own characteristics locally. Therefore it is very important to survey the distribution of environmental radiation levels anywhere for assessing its variation thereafter⁽¹⁾⁽²⁾.

For the purpose of grasping of environmental radiation fields in Hokkaido, a survey on the distribution of environmental gamma rays was made, using a portable spectrometer fitted with a high purity Ge semiconductor detector installed in a car - a car-borne survey -, during the period from Apr. 1994 to Aug. 1995. In addition to car-borne survey, in-situ monitorings were performed at spots sporadically.

In this paper, we will present the results obtained from the survey in Hokkaido Island, Japan.

METHOD OF MEASUREMENT AND INSTRUMENTS USED

Measuring method adopted for this survey was a car-borne survey in which measurements were made with the measuring systems installed on a car and made on cruising. Detectors used for gamma ray detection were a portable high purity Ge semiconductor detector and an NaI(Tl) scintillator detector. Figure 1 shows a schematic diagram of the measuring system installed on a car. During this survey we used the same car to be available the



T: Tripod G: HPGe detector N: NaI detector DA: DC/AC inverter C: Controller MCA: Multi-channel analyzer
PC: Personal computer S: Hanging spring H: Height from the ground surface (=80 cm)

Fig. 1. Schematic diagram of the measuring systems.

same conditioning not to vary the shield effect by car. Two detectors were set on a tripod to be fixed in the same position during the survey. Height of the detectors were 80 cm above the ground. Power from the cigar lighter of the car was supplied to the measuring systems through a DC/AC inverter.

Cruising speed of the car was kept 40 through 50 km/h. Every cruising of 40 or 50 km, spot monitoring was made. Measured intervals and spots were plotted on a map manually. The output from the high purity Ge semiconductor detector was stored on floppy disks by a personal computer. The output from the NaI(Tl) scintillator detector was printed out by its own printer.

TERM AND AREA FOR SURVEY

The survey over Hokkaido Island was taken place five times of cruising during the term from early spring in 1994 to summer in 1995. The areas covered were the proximity of Muroran City (i.e. proximity of Institute), northern part of Hokkaido, eastern part, south-western part, central part, and partially duplicated. Figure 2 shows the survey routes over Hokkaido.

ANALYSIS OF DATA

Data obtained directly from the detectors are energy spectra of counts on gamma events. We used the method of the HASL-258 by Beck et al.⁽³⁾ to discriminate nuclides of the gamma sources from the obtained spectra and summed up classifying into uranium-series, thorium-series, potassium-40, and fallout nuclides. The shield effect by car was 26 %.

RESULTS AND DISCUSSIONS

Figure 3 shows an example of the analyzed result obtained from the survey on eastern part of Hokkaido mainly. The lower part of the figure, lines denote the values of exposure rate in air in $\mu\text{R/h}$ due to uranium-series, thorium-series, potassium-40, respectively, and dots denote the total values of dose rate in nGy/h . The upper part of the figure shows ratio among three groups of nuclides mentioned above.

The figure shows not only remarkable variation on total absorbed rate against difference of area but also remarkable variation on constitutive ratio among uranium-series, thorium-series and potassium-40. In the figure, exposure rate of thorium-series varies remarkably as variation of location where measurement was made, but those of uranium-series and potassium-40 vary a little. Therefore amount of thorium-series seems to contribute mainly to the variation of the total absorbed dose rate.

Figure 4 shows a summary of the analyzed results on total absorbed dose rate in nGy/h over Hokkaido Island obtained from

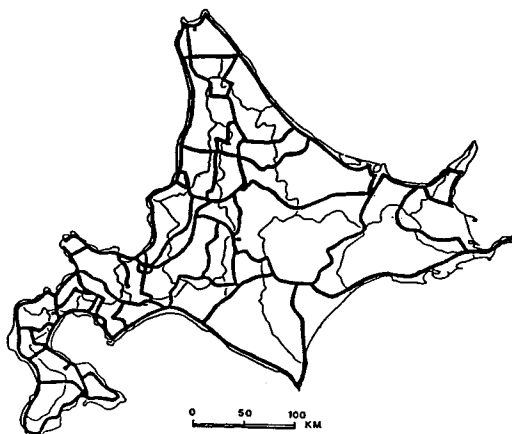


Fig. 2. Map of the survey routes over Hokkaido.

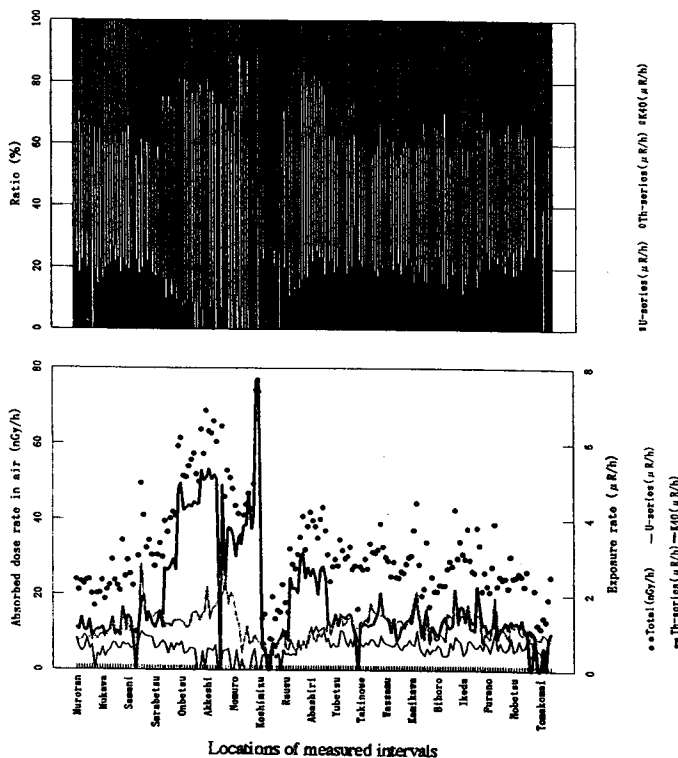


Fig.3. An example of the analyzed result as the analyzed results, obtained mainly from the survey on eastern part of Hokkaido.

the survey carried out during the period from Apr. 1994 to Aug. 1995.

Higher total absorbed dose rates were measured sporadically in some areas over Hokkaido Island, i.e. in northern part, in eastern part, and in south-western part of it. In these areas radiation due to thorium-series were higher than other districts. And also in some areas along survey routes, remarkable jump-up or jump-down of total absorbed dose rate was sporadically found.

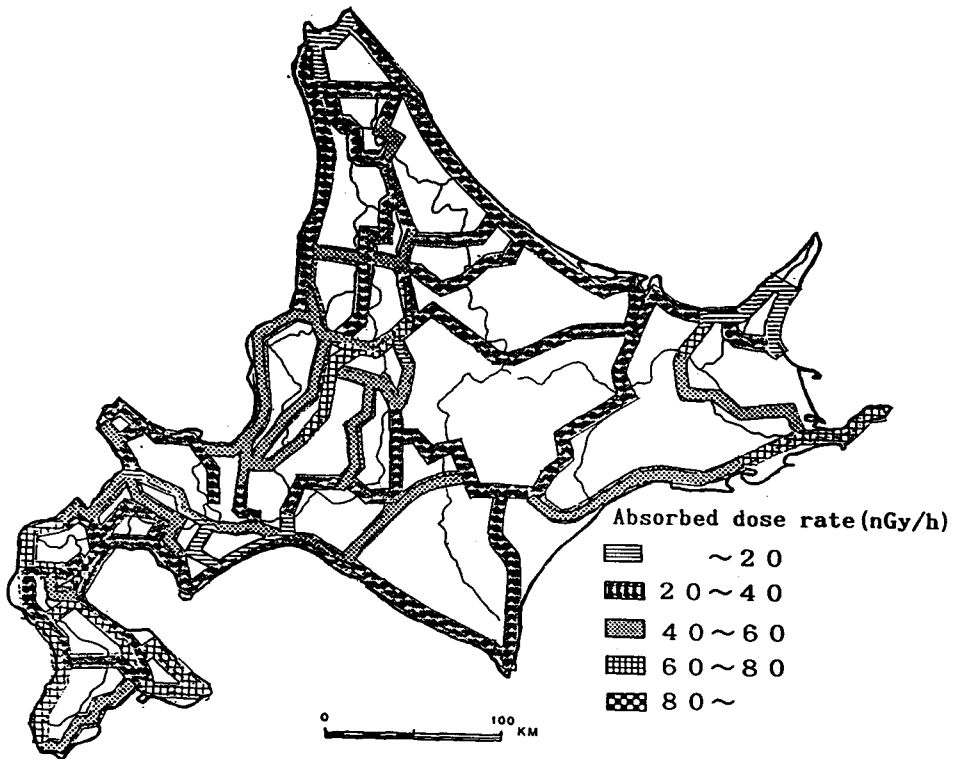


Fig.4. Summary of the analyzed results on total absorbed dose rate in nGy/h over Hokkaido Island.

CONCLUDING REMARKS

A survey on distribution of environmental gamma-rays was made along the almost all main roads in Hokkaido Island, using a portable spectrometer fitted with a high purity Ge semiconductor gamma ray detector installed in a car - a car borne survey -, during the period from Apr. 1994 to Aug. 1995. The values of absorbed dose rates in air due to gamma rays were found to distribute from 20 to 106 nGy/h, and mean dose rate was calculated to be 38.2 nGy/h.

The variation of total absorbed dose rate was seemed to be originated mainly in the variation of dose rate due to gamma rays radiated from the nuclides of thorium-series. Higher total absorbed dose rates were measured in some districts over Hokkaido Island, i.e. in northern part, in eastern part, and in south-western part of it. In these districts radiation due to thorium-series were higher than other districts.

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