

MEASUREMENTS OF GAMMA RADIATION IN SWEDISH HOUSES BY MEANS OF MAILED CaSO_4 -Dy DOSIMETERS

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SUMMARY

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The gamma radiation in houses originates mainly from the building materials. In addition, there are contributions from cosmic radiation and radiation from the ground. The main gamma radiation in building materials originates from the daughter products of Ra-226 and Th-232 and from K-40.

The National Institute of Radiation Protection in Stockholm, Sweden, has made a nationwide investigation of gamma radiation in Swedish houses. The occupants of 2,000 apartments and houses have been picked out at random and asked to participate in the investigation. The measurements were made with thermoluminescence dosimeters, CaSO_4 -Dy in teflon, diameter 12.7 mm and thickness 0.4 mm. Each dosimeter was surrounded by an energy compensation filter made from 1.0 mm Al and 0.7 mm Cu and a cover made from 3.0 mm polystyrene.

Three such detectors were sent to each of the selected dwellings by mail. The detectors were accompanied by instructions in which three different places in the apartment were carefully specified and the participants put the detectors in these places themselves. After a period of four weeks the participants were requested to send the detectors back for evaluation.

Absorbed Dose in the Detector During Mail Transport

It is necessary to determine the dose absorbed in the detector during the transport. Gesell, de Planque Burke and Becker (1) have found that the correlation between transport exposure and distance is very poor for long distance air transport. They suggest that a possible reason for this could be that some detectors had been transported or stored together with radioactive material. In the domestic Swedish mail the risk that a letter should be transported or stored together with radioactive material is very small.

The Contribution from Cosmic Radiation

Since the main purpose was to investigate the gamma radiation originating from the building materials, it was necessary to subtract the contribution from cosmic radiation. According to UNSCEAR (2) the

annual absorbed tissue dose at sea level from cosmic radiation is about 28 mrad (0.28 mGy). Measurements were made at sea outside Stockholm using CaSO_4 -Dy detectors to check the response of the detectors to cosmic radiation. The measured dose rate corresponded well with the UNSCEAR value.

Accuracy

The accuracy depends on the magnitude of the absorbed dose in the detector. For most of the measurements the accuracy is about $\pm 25\%$.

In the table below the preliminary results from 22 counties are presented. The tissue absorbed dose rate for a person staying 24 hours a day all the year in the apartment is given in mrad/y. The houses are classified into four groups according to the building material in the outer walls: wood, brick, concrete and aerated concrete (including concrete containing alum shale). The mean value for all measured houses are given at the bottom of the table.

Table: Absorbed Dose Rates in Swedish Houses. Preliminary Values.

Country	Building material in outer walls	Number of houses measured	Tissue absorbed dose rate** mean, mrad/y
Sweden 22 counties out of 24	wood	405	30
	brick	382	54
	concrete	221	68
	aerated concrete*	181	102
Sweden 22 counties out of 24	all kinds	1,189	56

*Mostly containing alum shale.

**The conversion factor from tissue absorbed dose rate (mrad/y) to air absorbed dose rate in air ($\mu\text{rad/h}$) is 0.165 according to UNSCEAR (2).

The mean value of the three measurements made in each apartment has been used in the table. The contribution from cosmic radiation has been subtracted.

References

1. Gesell, T.F., G. de Planque Burke, and K. Becker (1976). An international intercomparison of environmental dosimeters. *Health Phys.* 30:125.
2. UNSCEAR (1972). A report of the United Nations Scientific Committee on the Effects of Atomic Radiation, Vol. 1, United Nations, New York.