# Note on the Increase of Gamma Radiation from the Ground during September 1st—November 30th, 1961

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Registration of the $\gamma$-radiation some 2–3 meters over suitable areas seems to be a useful method of obtaining a general picture of the geographical distribution of radioactivity on the ground following nuclear weapon tests. A network of 25 stations for this type of registration was organised in Sweden during 1959–1960. Most of these stations have been in operation continuously since 1960. The apparatus used consists of a 4 litre high-pressure ion chamber with an electrometer tube connected to a device for marking a stroke on a slowly rotating disc each time a pre-set dose has been received. This device also operates a light signal and a counter which are in a conspicuous position in the living room of men who are in the meteorological service and who also carry out regular precipitation observations. The whole apparatus is battery driven, the batteries being replaced every nine months. The ion chamber is held at a constant temperature. The recording discs are changed every week and are sent to a collecting centre in Stockholm. This centre also is informed immediately by phone if any major increase in the radiation occurs.

The accuracy of the readings is demonstrated in Fig. 1, which shows the readings of two instruments placed a few meters apart. The instrumental errors obviously amount to less than $\pm 2$ %.

Under normal conditions the material is collected monthly as is shown in Fig. 2.

Calibration by means of a $\gamma$ source was originally carried out every week but it was later found to be sufficient to do this once a month. Corrections for changes in sensitivity are necessary only occasionally.

The variations of the natural $\gamma$-radiation level are partly seasonal and partly of short duration due to cosmic ray variations and short term meteorological variations.

The seasonal variations are mainly caused by the freezing of the ground which reduce the transport of radon and thoron from deeper levels to the surface and by the absorption of the radiation from the ground in the snow layer. Such variations have been reported in an earlier paper (SIEVERT, 1956) dealing with readings from the 6 stations in Sweden which were started in 1950–1953 and which are still in current use. The snow-effect with the new stations is seen from the detailed readings in Fig. 3 and Fig. 4.

The short-term variations are mainly dependent on precipitation. As is shown in the

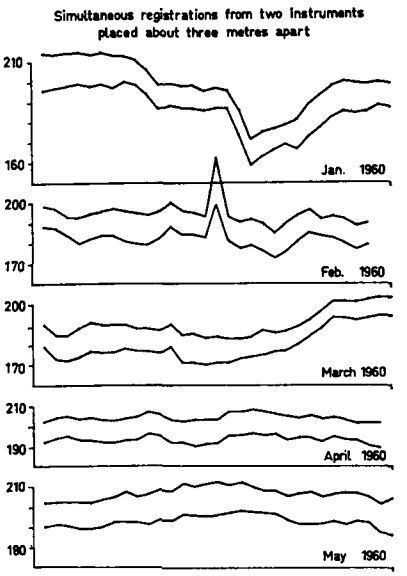


FIG. 1. Daily values in arbitrary units. The peak on February 16th is due to a temporarily applied radioactive source in the vicinity of the chambers.

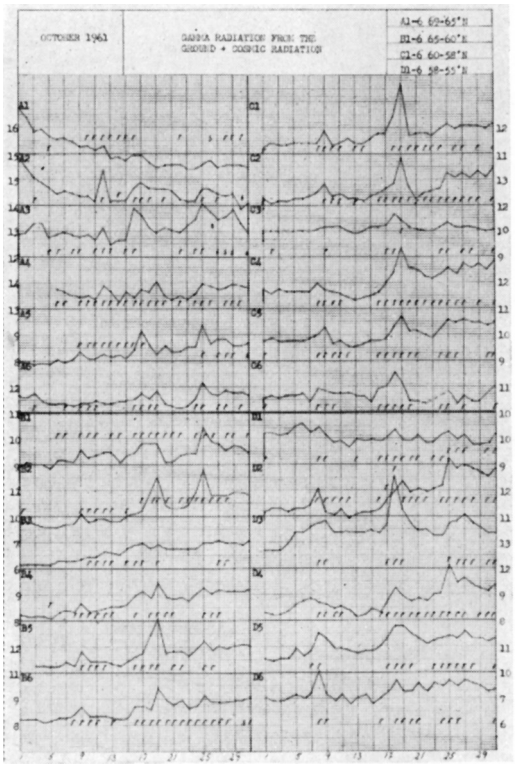

FIG. 2. Daily values in microroentgens per hour for all stations, October 1961.

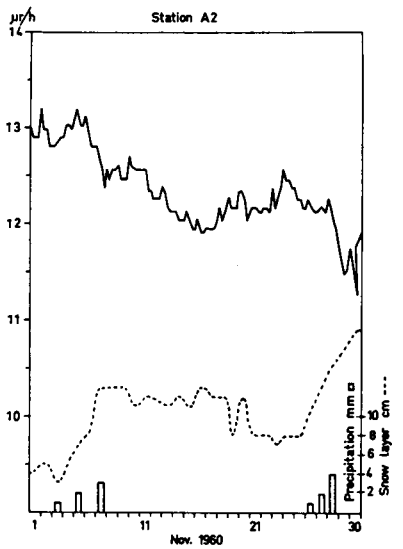


FIG. 3. Variations of the dose rate during the falling of the snow.

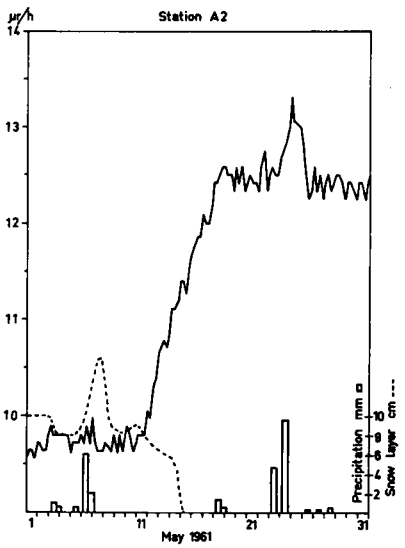


FIG. 4. Variations of the dose rate during the melting of the snow layer.

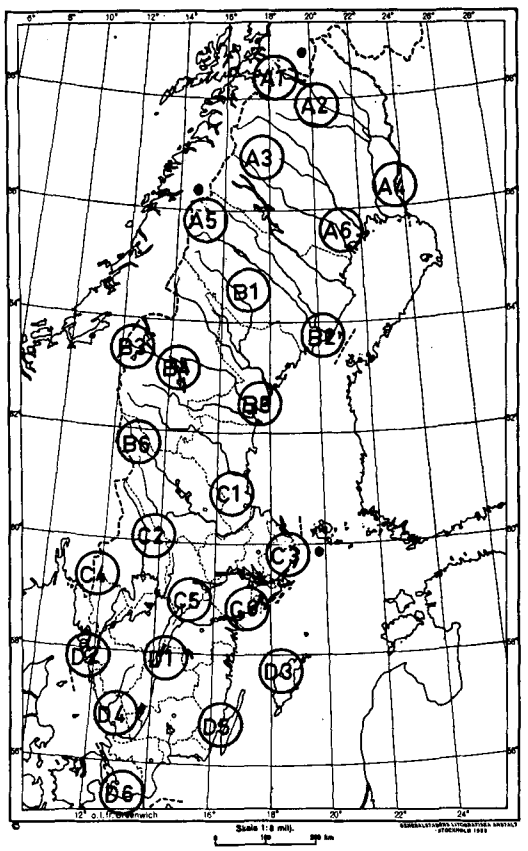


FIG. 5. Stations for the registration of gamma radiation from the ground (including cosmic radiation). On rock.

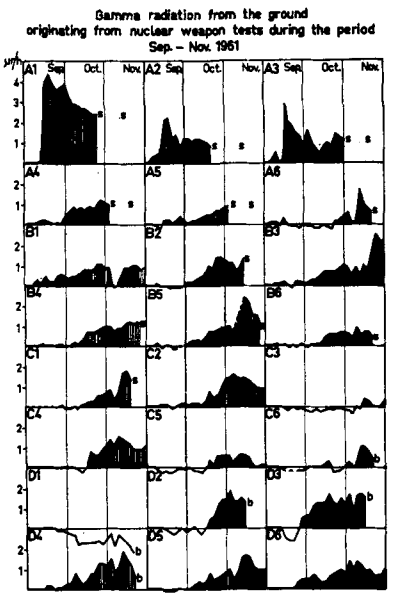


FIG. 6. Increase of the radiation from the ground during the period Sep.–Nov. 1961.
s = occurrence of snow layer
b = battery replacement
The curve for station D 1 shows the effect of a gradual decrease of the voltage of the batteries, which should have been replaced two months earlier. In A 1 and A 2 batteries were changed in the beginning of September but a satisfactory correction could be arranged for by repeated battery changes.

subsequent article by THOMPSON and WIBERG (1962) the natural radioactive substances coming down with the rain cause peaks which, with the present resolving power of the instruments, was found to amount to a maximum of 20–30 % of the normal natural level.

Correction must be made for the effects of natural radiation if small fallout quantities are to be observed, and this can be done by simply cutting off the peaks of short duration. During many days of continuous rainfall, this kind of correction might seem to give uncertainty. Previous experience has shown, however, that during such rainfall the natural radioactivity is gradually being washed out from the atmosphere so that the concentration of natural radioactive elements in the rain is decreasing. It must also be borne in mind that a heavy rainfall might transport part of the fission products to deeper levels in the ground, thus giving the impression of a smaller radioactive deposit than had actually occurred.

The map in Fig. 5 shows the site of the stations and Fig. 6 gives the distribution of the increase of the $\gamma$-radiation from the ground during the period from September to the time in October–November when the freezing of the ground and occurrence of a snow layer makes the observation of small fallout quantities impossible. In Fig. 7 a more detailed curve demonstrates the registration of relatively short-lived fission products at the station A 3 during the third week of September. From these figures it is seen that in Sweden there was both an increase of very local nature in the fallout in the North-West (maximum about 4 microrad per hour) and a more evenly spread fallout which was gradually increasing. In November 1961, this

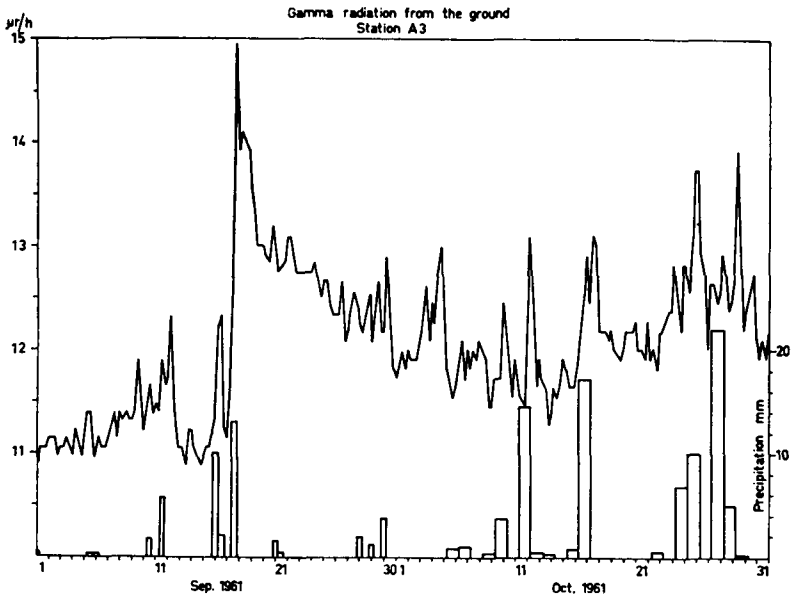


Fig. 7.

fallout was in most parts of the country 2–3 microroentgen per hour, i.e. about 25 % of the average natural radiation from the ground in Sweden including the cosmic radiation.

In any case it is obvious from the curves in Fig. 6 that any increase of the $\gamma$-radiation from fallout amounting to more than about 1–2 microroentgen per hour is easy to detect.

## REFERENCES

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