Radiation measurement of moisture in soil

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Soil moisture determination can be made more accurately by the neutron measurement [1]. Correct calibration methods are to be used. The weight distribution of neutron measurement is concentrated near measuring tube [2]. Therefore, it is very important that the near part of soil surface around the measuring tube is so natural as possible. A problem of the use of the neutron device is the measurement near the soil surface. A good measurement of moisture there is to measure the density change using gamma radiation attenuation between two vertical tubes [3].

The n-gauge for soil moisture measurement have 3 important parameters: hydrogen content in dry soil, soil density and thermal absorption cross section of soil. Hydrogen content at a point can be determined from a sample of soil matter taken when the hole for the measuring tube was drilled. The density can be measured separately. The thermal absorption cross section can be measured from the sample. In Nordic countries I have not seen the elimination of this error source. In France, Poland and elsewhere it has been done. For the n-gauge of the firma Nucletronics ApS this should be arranged and in good calibration applied..

In calibration the diffusion calculation has been used [2]. Theoretically this method of calculation is questionable. Good calculation is the Monte Carlo method. In 60's I started its application, but the application is still unfinished. This should be continued. With the MC the goodness of diffusion methods can be checked.

In Finland has been used Nucletronics ApS 30 mCii = 1110 MBq AmBe-n-source. The firma announces that the neutron and gamma dose rates from the unshielded gauge are together 3 µSv/h at 1 m distance. In Finland the mean value of the environment dose rate is 0.1 µSv/h, so that you must stay at 5 m distance from the gauge, that these dose rates are equal. --- An alternative for AmBe n-sources is TD(or DD)-neutron generator [4]. That can operate even in pulses. In [4] you see in Figures 7, 9 and 10 large H-peaks (2.2 MeV). The simulation program MCNP6• is a MC one.

REFERENCES

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