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A Few Remarks on Isotopic Methods

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During the week we have listened with great interest to a large number of lectures dealing with a few aspects of grund-water tracing. I must admit that some of them I understood better than others depended primarily on the language.

Among the methods discussed and demonstrated were also the radioactive methods. I would like to summarize them, to your benefit, and add a few observations of my own to the discussions of the week.

The subjects mentioned were:

1. Stream flow gauging
2. Interconnection tracing
3. Ground-water velocity
   a) Filtration velocity
   b) Single well pumping
   c) Multi well pumping

All these methods utilize radioactive tracers or a different nuclear technique (such as activation analysis or neutron scattering and thermalization). We have observed some of them in action, mostly for qualitative analyses, side by side with other classical methods. It is obvious that the biggest advantage of using radioactive tracers is the very high sensitivity and thus lack of density effects, and the possibility of quantitative determinations in the field.

These methods are but a part of the nuclear and isotopic techniques in hydrology. Among the methods not discussed here, and which we advocate and exercise are:

1. *Tracing tests,* to determine aquifer characteristics, for example, effective porosity or stratification and studies of ground-water mixing and storage.

2. *Environmental studies.* These were only mentioned in passing by Prof. MOSER and Mr. GUIZERIX. These methods utilize the information gained by the determination of cosmic ray produced ^{3}H and ^{14}C for dating purposes, ^{3}H pulses introduced by man-made explosions, and

changes in the isotopic composition of water with respect to the stable isotopes ^{16}O, ^{18}O, ^{1}H and ^{2}H resulting from evaporation and condensation processes. These methods are direct methods for gaining such valuable information such as:

a) Identification of recharge areas

b) Transit time

c) Turnover times

d) Velocity of ground-water

e) Interconnection between water bodies

The IAEA is making its best, within the limited funds available, to promote and encourage the research and application of these methods. This is achieved through the Agency's Research Contract Programme (and several speakers mentioned a grant which had been awarded by the Agency), through meetings of panels of experts, working groups, participation and organization of symposia, and cooperation with FAO.

The Coordinating Council of the IHD has requested the Agency to serve as technical secretariat for one of the IHD working groups, the one dealing with nuclear techniques in the unsaturated and saturated zones. The first meeting of this group took from 21 to 25 March, 1966, in Vienna.

The Agency is cooperating with FAO on many Special Fund Projects dealing with water resources development. In all these problems the environmental approach is practised. At the moment we are engaged in Turkey, Jordan, Jamaica and Niger and many other investigations are planned. As a direct contribution to the IHD the Agency is cooperating with Austrian authorities on an extensive study of the Vienna Basin.

In more than one case, the use of nuclear techniques provided information which could not be obtained otherwise, or supported by an independent approach a result or a theory obtained by a different method. The Agency is always at the service of member states interested in defining the problems or areas where nuclear methods may be successfully employed. Through its technical assistance programme fellowships, experts and equipment may be requested.

I would like to take this opportunity to announce that the second International Symposium on Isotopes in Hydrology, organized by the Agency in collaboration with the International Union of Geodesy and Geophysics took place in Vienna 14—18 of November 1966 proceedings of the Symposium will be published by IAEA and will be available about April 1967.