Editor's Message

Hydrology, Isotopes, and the International Atomic Energy Agency

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During the last decade, the attention of the scientific community dealing with water resources has focused to a great extent on improved management strategies through an integrated approach. These efforts deal not only with the flux of water but also the flow and circulation of water, based on improved understanding of the interrelationships and interdependency of the physical, chemical, and biological processes involved. Knowledge of these processes is needed to evaluate sustainability of the resource in terms of its quality. A multi-disciplinary approach is required to identify the extremely complex cause-effect relationships among the processes that occur during transport and transformation of water and its constituents along flow pathways. Integration of the principles and available techniques in physical hydrology, hydrochemistry, and isotope hydrology provides the most effective approach to understanding the compositional response of natural hydro-ecological systems to stresses being imposed on water resources.

The field of "Isotope Hydrology" has been emerging and contributing to the scope of methodologies available to scientists and engineers involved in water resources and related environmental studies. One area of contribution has been improvements in nuclear analytical techniques for low-level counting and isotope-ratio mass spectrometry. In addition, new applications that are based on naturally occurring isotopic species, often referred to as "environmental isotopes," offer convenient tools for assessing time/space integrated responses. These tools are especially helpful for process tracing, particularly in hydrogeological studies of regional-scale groundwater systems. The methodologies have particular applications in studies related to identifying the "genesis" of water, tracing component flows and their pathways, understanding mixing dynamics, and indirectly estimating travel times of water. International effort is certainly required to more effectively incorporate environmental-isotope methodologies into the overall domain of water-resources assessment and management practices.

In this context, nuclear science and technology in the water-resources sector has been an integral part of the programmes of the International Atomic Energy Agency (IAEA) since its inception in 1958. IAEA's activities in this specific field during the last four decades constitute a major contribution toward development, field verification, and application of isotope/tracer techniques. "Isotope Hydrology" is now an internationally recognised scientific discipline, partly as a result of this effort. A substantial amount of field data and experience has been acquired by the IAEA in isotope hydrology, and information exchange at an international scale is being achieved through publications and meetings. Further refinement of isotope methods is supported by the implementation of co-ordinated research programmes. Joint international efforts toward advancement of water sciences as a whole will be greatly strengthened by participation of national and international institutes in the research and development programmes of the IAEA, as well as through practical applications of isotope hydrology.

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